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THE

AMERICAN NATURALIST,

A

POPULAR ILLUSTRATED MAGAZINE

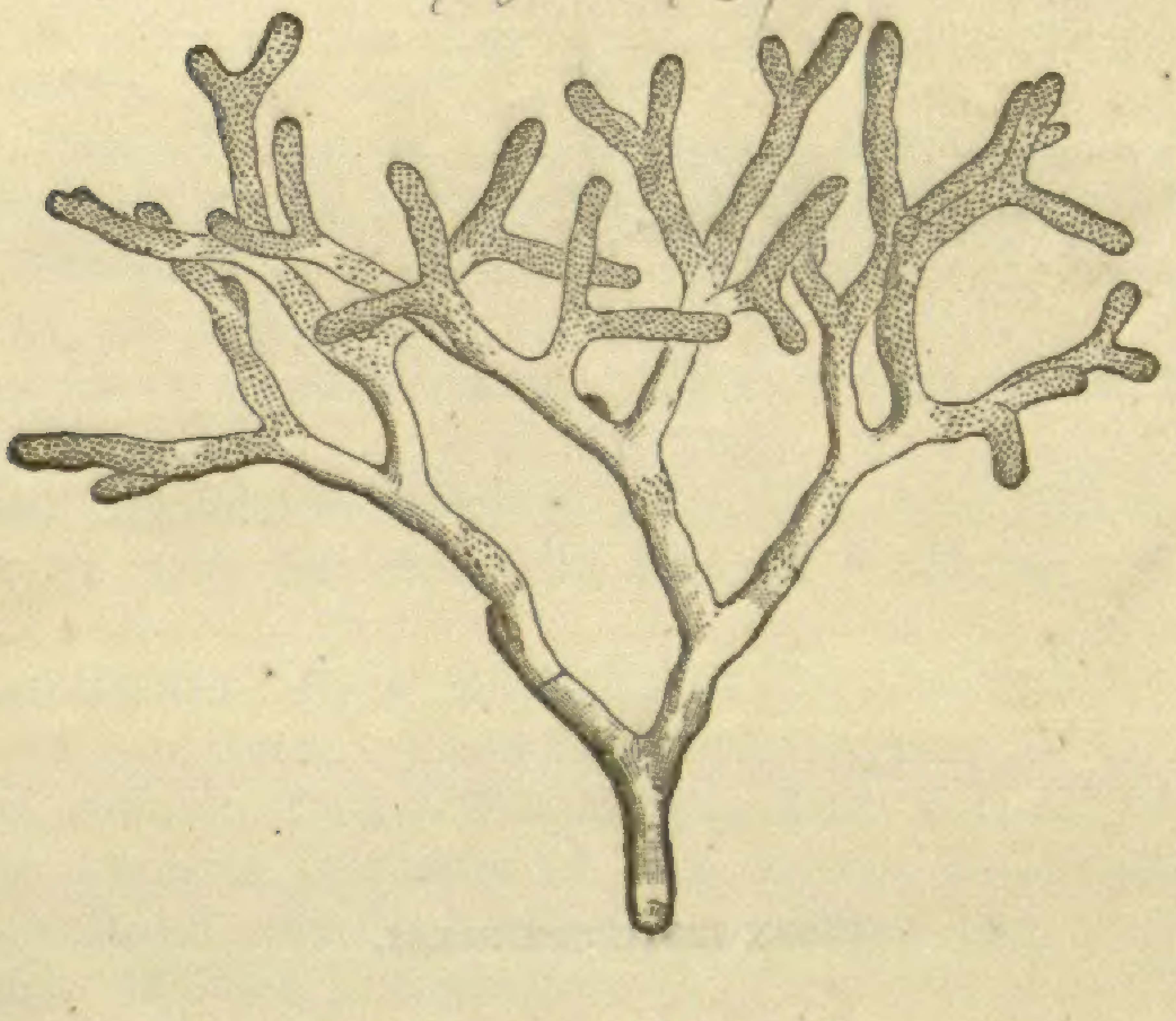
OF

NATURAL HISTORY.

EDITED BY
A. S. PACKARD, JR., E. S. MORSE, A. HYATT AND F. W. PUTNAM.

VOLUME II.

1868/69



SALEM, MASS.
PEABODY ACADEMY OF SCIENCE.
1869.

Mo. Bot. Garden
1913

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ESSEX INSTITUTE PRESS.

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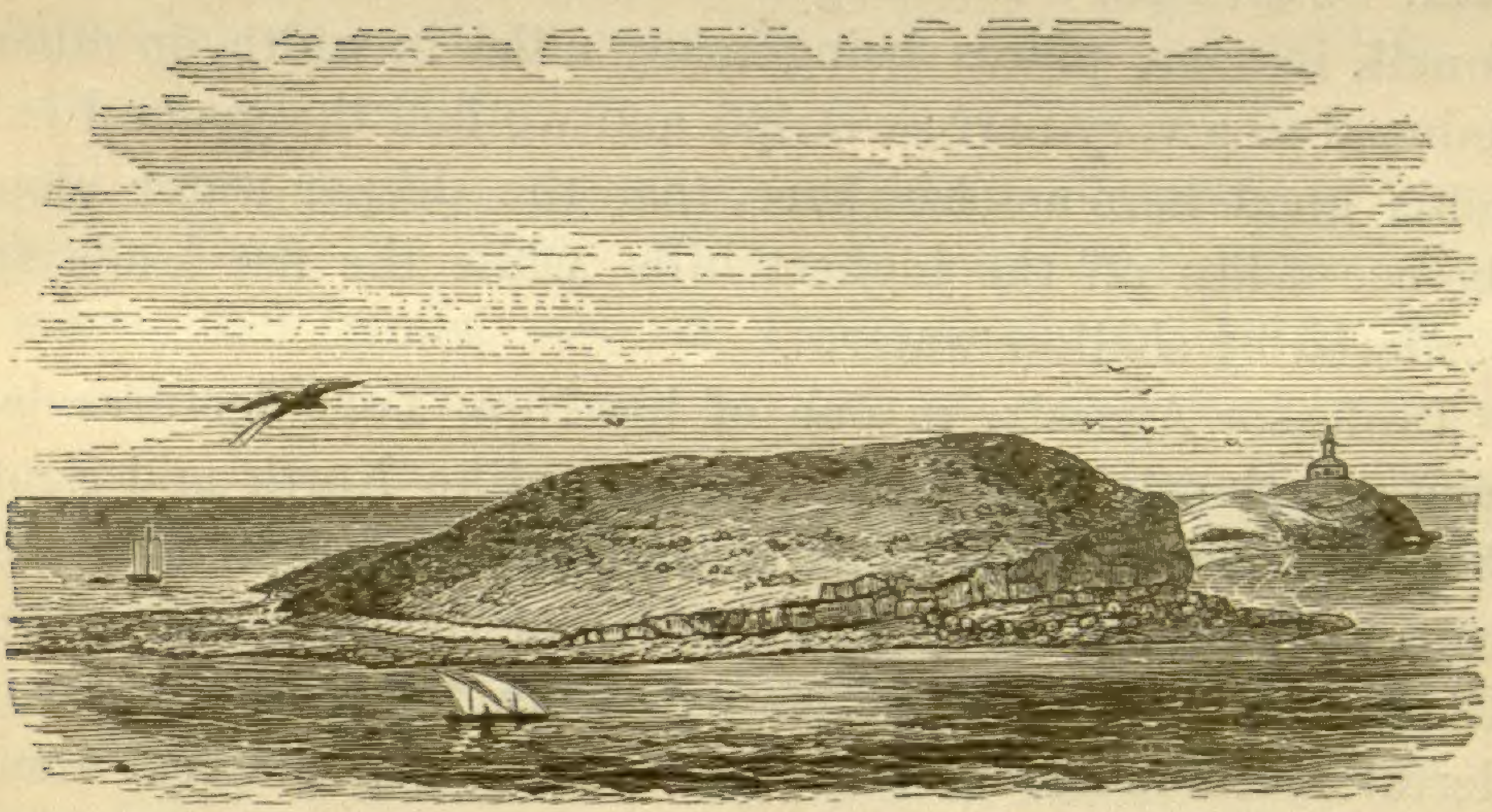
THE

AMERICAN NATURALIST.

Vol. II.—MARCH, 1868.—No. 1.

A NATURALIST IN BRAZIL.

BY C. FRED. HARTT.



SANTA BARBARA DOS ABROLHOS.

THE shore-line, where ocean and land meet, is rarely ever the edge of a continent. Both North and South America have a submerged border, in some places very wide, in others very narrow. Thus, off the coast of New England, the water does not deepen immediately at the shore-line, but the sea-bottom slopes off very gradually, sometimes, the water becoming ever deeper and deeper, until at a distance of many miles from the shore the true brink of the great valley occupied by the waters of the ocean is reached, and

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thence seaward the bottom slopes rapidly down beneath the almost unfathomable depths of the ocean. The walls of the continent do not arise perpendicularly from the ocean floor; they slope, to give greater strength and stability to the structure. As a general rule we know that the water which borders a low coast is shallow for some distance out, the sea-bottom continuing under water with the same general slope as the land. New Jersey is a State whose coast-lands are low and flat, and we find that the sea-bottom bordering it grows very gradually deeper and deeper, in such a way that the true edge of the continent, or of the ocean, properly speaking, lies at a distance of about eighty miles from the land. Just such a submerged border runs along the coast of Brazil, in some places being many miles in width, in others reduced to a very narrow strip; and we find the general rule holds good here as elsewhere, that the deeper water along the coast lies off the highest hills, while the flat lands are bordered by shallow water.

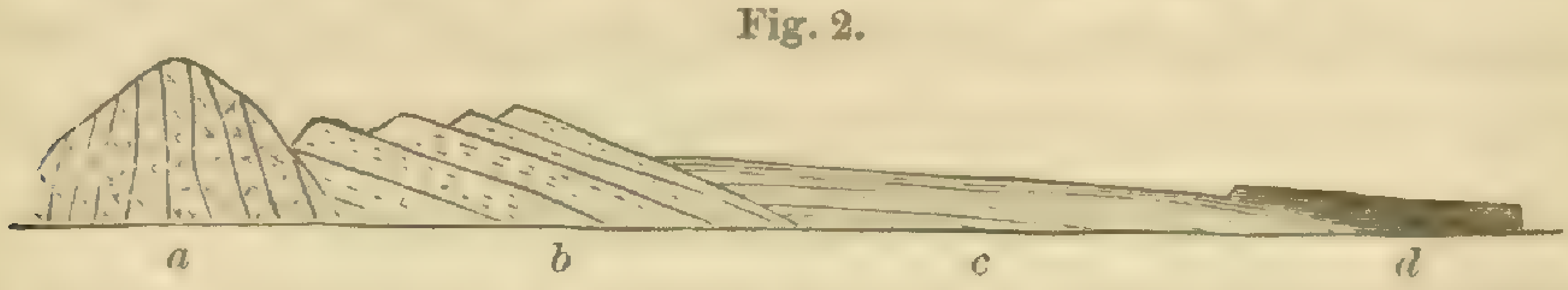
Professor Agassiz, in one of his New York lectures last winter,* showed how very strikingly alike North and South America are in their general and physical features. Not only is this true, but an examination of the eastern coasts of Brazil and the United States will show that there is a wonderful resemblance in the details of their geological structure. Thus, running all along the eastern coast of the United States, we find a range of mountains in which some of the oldest stratified rocks are upheaved, and on the eastern flank of these mountains, south of New York, are low lands occupied by more recent formations, thick beds of sandstone of the Triassic age and beds of marls, etc., of the Cretaceous; and over these, again, deposits of Tertiary and recent times.

I take a big Webster's dictionary, open it a little and

* Cooper Institute, February 5, 1867. In his lately published Journey to Brazil, Professor Agassiz has carried out this comparison between the two Americas to a much greater extent.

stand it on edge with the covers sloping like the eaves of a house. This book I place before me in such a way that the line of the back will point towards the north-east. This will represent the Alleghany Mountains. Now I take a thinner book and lean its back against the south-eastern side of the dictionary so that it will slope off to the south-eastward, but very much more gently than the covers of the dictionary. This second book will represent much newer strata, which recline against those of the Alleghanies. Among those in New Jersey are thick beds of a coarse red sandstone, the material out of which brown-stone houses are so commonly made in New York City and elsewhere. Geologists call this Triassic or New-Red Sandstone. These beds have been tilted up since they were formed. Now let us take another book, and lay its edge just on that of the one last laid down, so that it will lie almost horizontally and much lower than the rest. This will represent newer strata, marls, and sands, etc., of Cretaceous age, which lie still undisturbed in the same position in which they were laid down. Take another book, and lay it so that its edge will overlap that last laid down, and this will represent beds of sands, etc., which were deposited after the Cretaceous, and which geologists call Tertiary strata. These are also undisturbed, and in the same position as that in which they were deposited. As we go southward, the Triassic rocks disappear from view, and the Tertiary beds lap over the Cretaceous, so as to bury them completely. All this will appear more plain from the following figure, which is an

Fig. 2.

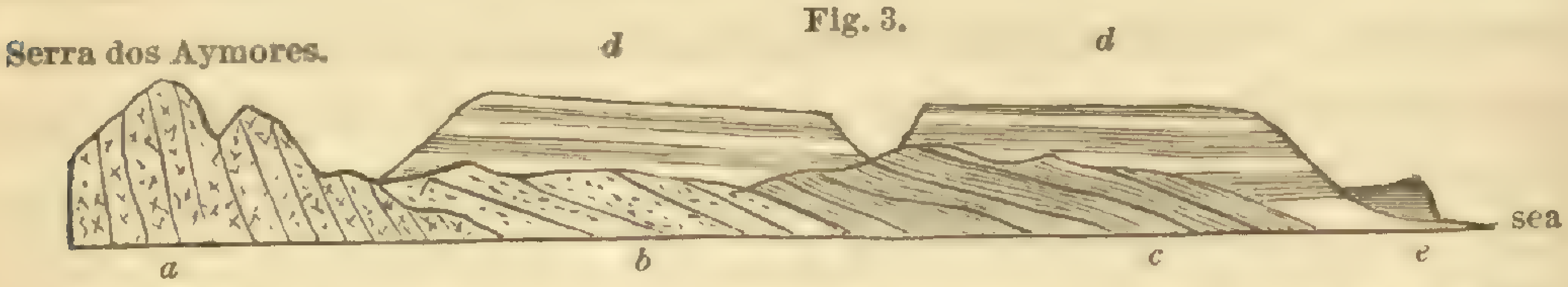


ideal section across the strata of New Jersey, from the mountains to the sea. *a* represents the upturned beds of gneiss, etc., of the mountains, against which lie inclined the Triassic, or New-Red Sandstone strata, *b*. Those marked *c* are Cre-

taceous, while *d* represents the latest deposited, or Tertiary beds. Now it is evident that the beds *a* are the oldest, and were the first disturbed. The Triassic rocks were deposited against them and slightly tilted up, and over these were laid down the beds of the Cretaceous and Tertiary.

If I make a similar section across the coast of Sergipe, a little province lying on the coast of Brazil just north of Bahia, from the gneiss hills to the sea, we shall find almost precisely the same structure, as is exhibited in the following section :—

Fig. 3.



a is the gneiss of the coast mountains, and is probably Azoic; *b*, beds of a coarse red sandstone, precisely like the Triassic, or New-Red Sandstone of New Jersey, and most probably of the same age; *c*, limestones and sandstones with fossils characteristic of the Cretaceous epoch, such as *Ammonites*, *Inoceramus*, etc., and *flint*. It is worthy of note, that whereas the Cretaceous strata of North America have suffered upheaval and folding only in the west, those of the eastern border of Brazil had been folded and disturbed prior to the deposition of the Tertiary strata *d*, which, occupying a higher level than on the east coast of the United States, everywhere lap completely over and bury the formations which occupy the lower grounds bordering the coast. Southward of New Jersey, as well as in the Mississippi valley, we also find the Cretaceous overspread by the Tertiary.

In this section *e* represents beds of sand containing shells, etc., of recent species, which have been raised above sea-level by the late, and probably now-continuing up-rise of the coast. Of this rising of the coast we have at Rio and elsewhere abundant evidence. One finds the nests excavated by sea-urchins in the rock, six feet or more above high tide-level. At Rio the upheaval amounts to about eight feet. In

North America the last great upheaval was greater in the north than in the south. Facts seem to show that in South America it was just the reverse.

About half-way between the cities of Bahia and Rio de Janeiro, and distant about forty miles from the mainland, there is a little group of islands, which, lying right in the way of navigation along the coast, and surrounded by dangerous reefs, have long been known as the *Abrolhos*, or "*Open-your-eyes*" Islands.

If we make a section across the country from the coast mountains, which separate the provinces of Minas Geraes and Bahia, to the sea, and then continue it to the Abrolhos, we shall have one like the following:—

Fig. 4.

a, Gneiss; *b*, Tertiary strata; *c*, Cretaceous strata; *d*, Coral reefs.

In this section the New-Red Sandstone and Cretaceous beds do not appear on the main-land, at least so far as I have seen, and usually, as on the river Mercury, we find the Tertiary clays and sandstones lying immediately over the gneiss. But at the Abrolhos Cretaceous rocks appear, for the islands are seen to be composed of beds of shale, sandstone, etc., similar in character to those of the Cretaceous farther north. These islands stand about in the middle of the submerged border of the continent, which is here at least seventy miles wide. This submarine shelf is overspread by Cretaceous rocks, which, at the Abrolhos, have been broken and uplifted so as to form a little group of islands.

The Abrolhos consist of four principal islands, and two little islets. These are arranged close together in an irregular circle. All are quite high, the height of the principal one, Santa Barbara, being 33.22 metres (about 109 feet). This is the largest, and is three-quarters of a mile in length. On its

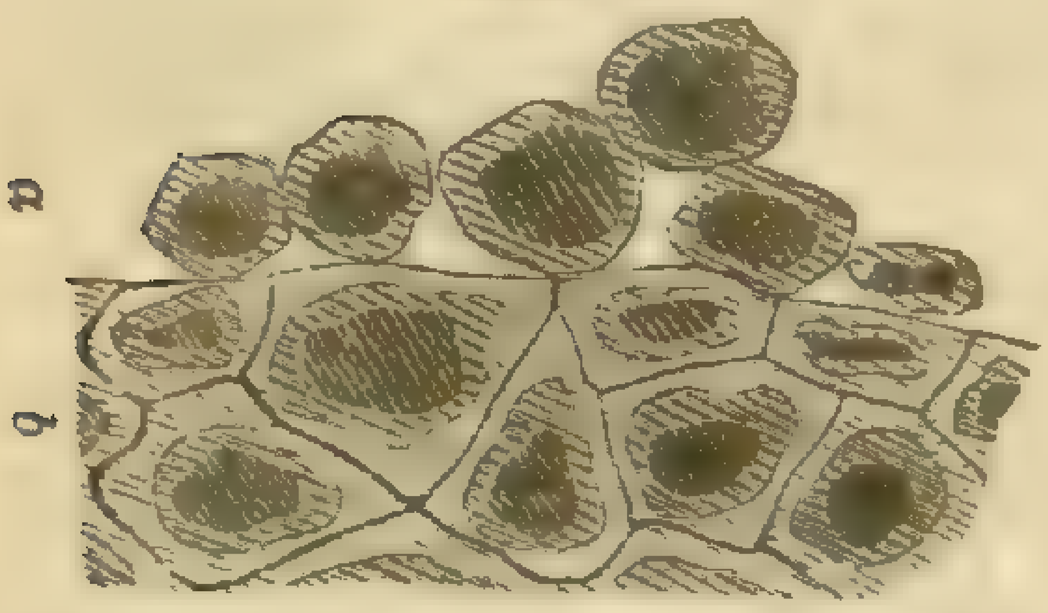
summit is a very fine light-house, whose attendants, three men, are the only human inhabitants of the islands. The strata composing this island are inclined to the N. N. W., approximately, at an angle of 10°–15°, so that the island has a slope to the northward, while on all other sides it is precipitous. The surface is mainly composed of a bed of trap, which is spread out over the other rocks, as is seen in Fig. 5.

Fig. 5.

Section across island of Santa Barbara, Abrolhos. *a*, Shales and yellow Sandstones; *b*, Trap.

It is a wonderful thing to see how rocks decompose and rot away in Brazil. Even gneiss and slate grow soft to a depth sometimes of even a hundred feet. This trap-bed at the Abrolhos is decomposing also, but this takes place in a very interesting way. The trap, which is a very hard and heavy dark-bluish rock, is cracked up on the surface into angular pieces of all sizes, as represented in Fig. 6.

Fig. 6.



If the rock were smooth and unbroken on the surface, it would decompose only on the upper surface, but water soaks in through these cracks, and each fragment decomposes all around, so that a concentric coating of rotten rock is formed (Fig. 6, *b*), which may afterward be removed by rains. Thus each piece loses coating after coating like the layers of an onion, becoming ever more rounded in form as this goes on, until at last the surface of the bed is covered over with rounded boulder-like masses, often resembling cannon balls (Fig. 6, *a*). Nearly the whole surface of the island of Santa Barbara is covered by these rounded masses of trap.

The vegetation of the island is very scanty, and, save a *Siriba* on the island of that name, to which bear company two dwarf cocoa palms, trees there are none. Several species of coarse grass abound, and give sustenance on Santa Barbara to a herd of many hundreds of goats. There are some thickets of dwarf mimosas, and a few ferns, etc.

The land animals consist of lizards, of three or four species, which are considerably numerous. Insects are few, and the principal representative of the class is an immense hairy spider (*Mygale*), of a species very common on the coast. This spider, which the Brazilians call *Aranha caranguejja*, or *crab-spider*, has a body sometimes as big as an egg. It exists in countless numbers, living under stones. Almost every loose stone has one of these monsters under it. The bite from its long fangs is very painful and poisonous. It preys on lizards, and has been known to kill young chickens, and suck their juices.

Sea-birds resort here by myriads, at certain seasons of the year, to breed. Among these there are several species of gulls, pilots, and the magnificent frigate-bird. To these birds and their habits we may, perhaps, by and by devote a special paper.

It is in the waters of the vicinity, however, that the greatest riches of animal life are to be found. Fish, of an incredible number of species, are wonderfully abundant, and a regular fishery is carried on here from the town of Porto Seguro for a giant perch called the *Garoupa*, which fish is however cured so badly as to be scarcely eatable.

In the month of May, a species of whale (*Megaptera*) makes its appearance on this coast in considerable numbers. It is furnished with whalebone, and has on the back a hump of fat which looks very much like a fin. Above, it is black in color; below, usually white, or light-colored, and marked by longitudinal furrows, which are especially conspicuous under the throat. Along the lower jaws there is a number of round lumps, or tubercular masses of fat, as large as one's fist. The pectoral fins are long, narrow, and irregular along the edges. This whale grows to be thirty to forty feet in length.

Among the first to make their appearance at the commencement of the season are large females (*Madrijos*), bringing with them their little ones but just born. The

whalers say that they resort to the islands and reefs for protection. The males are not so numerous, nor are they so valuable to the whaler. I once saw a female swimming with its calf. The latter swam close alongside its mother, following all the motions of the latter, and coming up to breathe at the same moment. The whalers all told me that the female holds out her fin obliquely, and that the little one swims with its head between it and the body. They denied that this whale ever clasped the young under the fin. This species is very lively and difficult to catch, notwithstanding which a small fleet of boats stationed at Caravellas captures every year some thirty to seventy whales, which afford a large quantity of oil. These two fisheries, that of the *Garoupa* and whale, deserve attention on the part of American fishermen, as they might be developed so as to become very profitable. The whales leave the coast in the latter part of September or in the early part of October. They occur also all along the Brazilian coast, but Bahia is the only other place at which they are systematically fished. Considerable numbers are caught here every year, and, during the season, one may sit at his breakfast at the restaurant in the hotel in the upper town, and watch the pursuit and capture of one of these monsters in the bay, almost under his very window.

It has long been known that the waters of the Abrolhos and vicinity were made very dangerous to navigation by extensive reefs, which covered large areas just outside of the islands, as well as between them and the main-land. In the descriptions of the Brazilian coast in the various "Coast Pilots," both English and foreign, that I have seen, very conflicting statements are made with reference to these reefs, some saying that they are composed of coral, others of decomposed gneiss; and the different kinds of reefs are confusedly described, so that it is not easy to distinguish, from these descriptions, reefs of rock, reefs of coral, or solidified beaches, like that of Pernambuco, which last, being separated from the land by the washing away of the loose sand of the

upper part of the beach, as well as from behind, are left standing like walls of sandstone running parallel to the coast. In scientific books it is generally stated that there are no coral reefs on the coast of Brazil.

While engaged in the late Thayer Expedition under Professor Agassiz, in company with Mr. Edward Copeland, the writer discovered some quite extensive reefs in the bays of Santa Cruz and Porto Seguro, and made out, in a general way, their structure. Fishermen and pilots described the reefs of the Abrolhos as precisely like those at Porto Seguro, and a note in a chart of Lieutenant Mouchez, which afterwards fell into the writer's hands, left no doubt of the existence of extensive coral reefs in that region. The return of the Expedition left no time for their exploration, but the writer, during his visit to the Brazilian coast last summer, gave them a careful examination.

Many species of polyps grow along the coast of Brazil, even as far south as Cape Frio, and the bay of Rio offers a few insignificant coral building species, principally an *Astrangia* or two, which form scattered cells on dead shells or stones. There is at Rio quite a number of species of soft-bodied polyps, of the order of the *Sea-anemones*, and some of these are very beautiful. In the same bay representatives of the highest order of polyps, the Halcyonoids, are not numerous. The most interesting is a species of Renilla (*R. Danæ* Verrill),* a curious "family" of polyps, in which all the bodies of the animals are joined together, and clustered on one side of a leaf-like expansion, to which there is a single appendage like a stem, by which the whole moves about like a single individual.

South of Rio de Janeiro there appear to be few polyps which have calcareous skeletons; but on the rocky shores northward a few species soon begin to become quite common.

*I am indebted to the kindness of my friend, Professor Verrill, for the determination of the Radiates mentioned in this paper.

In the rocky tide-pools of Os Busos, Guarapary, Victoria, Porto Seguro, etc., to Bahia, we find them quite abundant. There is a massive kind growing in rounded, flattened lumps or patches on the rocks belonging to the genus *Siderastræa.** It has small, close-set cells, and grows in masses often a foot or more in diameter, and occasionally several inches in height, encrusting the rocks. With this there occurs a little, irregularly globular coral, an inch or two in diameter, and with large, irregular, crowded cells, in which the radiating plates are very conspicuous (*Favia*, like *ananas* Edw. and Haime). In deeper water we find a large *Acanthastræa* (*A. Braziliensis* Verrill)† growing sometimes in round heads a foot or more in diameter, together with large bouquet-like masses, often a foot across, of a beautiful coral (*Mussa Harttii* Verrill),‡ whose branches, thick and long, are cylindrical, forking, radiating from the same point, and with the cells at the ends of the branches large and deep. There are several other species of hard limestone building

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* *Siderastræa stellata* Verrill sp. nov. Corallum forming rounded or hemispherical masses, often flattened above. Cells polygonal, rather large (about .15 inch) deep, the central part rapidly descending. Septa in four cycles, those of the first two cycles considerably broadest, all of them evenly crenulated, rather thin, thickness less than the intervening spaces, slightly projecting, the inner edge evenly rounded. Columella inconspicuous, represented only by one or two tubercles. Wall between the cells represented by a simple line. Trabicular processes between the septa very distinctly seen from above. Differs from *S. radians* in having larger cells, which appear more open; thinner septa, and consequently wider intervening spaces, and four complete cycles of septa. — A. E. V.

† *Acanthastræa Braziliensis* Verrill. A large species, forming hemispherical masses a foot in diameter; margin of base surrounded by a strong epitheca; cells large, varying from .3 to .7 of an inch in their largest diameter, but mostly about .5 inch, irregularly polygonal, often much elongated, and then having two or more centres, moderately deep (.15 inch), centre depressed, columella but little developed. Septa thin, in five cycles, the last usually incomplete, projecting subequally, the upper part divided into from three to five long, sharp teeth, below which the teeth are smaller and more slender. Walls between cells sometimes single, often double with vesicles between. — A. E. V.

‡ *Mussa Harttii* Verrill. A beautiful species, forming large clumps with rather small branches, and simple, subcircular cells. Branches rapidly dividing, mostly .5 to .8 of an inch in diameter, the living part extending from .2 to .5 of an inch from the summits, and often surrounded by an imperfect epitheca, covered with strong, subequal costæ, with numerous sharp, nearly equal, recurved spines. Cells from .5 to 1.2 inches in diameter, subcircular, often irregular, with waved margins, rather deep (.4 to .5 inch). Septa in five cycles, thin, subequal at summit, where they project about .1 of an inch, the upper part divided into from four to seven unequal, sharp, diverging teeth, with

corals. *Millepores*,* corals often with flat, ragged-edged branches, like the antlers of an elk, and with very small pores like pin-holes, are not uncommon.

In many localities south of the Abrolhos district, these corals grow quite abundantly, but I have no evidence that they ever form reefs or banks. Reef-building corals, according to the best authorities, flourish only at depths less than one hundred feet. They also require a warm temperature of the water. The great shelf of the Abrolhos lies over a very large area, at a depth of less than a hundred feet, and the conditions for the growth of corals are of the most favorable kind. In consequence of this, we find here not only around the islands, but in the shoal, open waters, very extensive reefs and banks, which, in an area of fifty miles square, occupy a space of nearly one hundred and fifty square miles.

When the tide goes out, there is seen extending around about one half the island of Santa Barbara, as is shown in the illustration at the head of this article, a fringing reef of coral, out on which one may walk, as on a low wharf at high tide, and from its ragged edge look straight down through the limpid green water, and see the sides of the reef and the sea-bottom covered with huge whitish coral-heads, and a wealth of curious things not easily to be got at.

The surface of the reef is quite flat, and rises but a short distance above low-water mark. It is rather irregular, and is overgrown with barnacles, shells, mussels, and serpula-tubes, and overspread with large slimy brownish patches, of

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smaller teeth below. Columella slightly developed, consisting of slender, loosely arranged, contorted processes.—A. E. V.

*The most abundant species is *Millepora nitida* Verrill. A very distinct species, forming low, rounded clumps, four to six inches in diameter, consisting of short, rapidly forking, rounded, or somewhat compressed branches, about .4 to .8 inch in diameter, which have a remarkably smooth surface, and are obtuse, rounded, or even clavate at the ends. The larger pores are small, very distinct, round, evenly scattered over the surface, at distances of about .06 to .1 of an inch apart. The small pores are minute, numerous, scattered between the large ones, and often showing a tendency to arrange themselves around them in circles of six or eight. The tissue is more compact and firmer than in *M. alcicornis*.—A. E. V.

a soft-bodied, encrusting polyp (*Corticifera*), of a leathery color.

The reef abounds in small pools, some of which are shallow and sandy, others deep, rocky, and irregular. The former often contain scattered corals, *Siderastræa* and *Favia*, and are rich in small shells, crabs, *Ophiuræ*, etc., but the latter are the most interesting.

Fancy, my reader, a pool of the purest sea-water held in an irregular rock-basin a few yards across, full of little grottoes and niches, and three or four feet deep. Carpet this pool with white coral sand and broken shells, and tapestry heavily the sides with soft fringes and curtains of delicate, brilliant-hued sea-weeds. Plant here and there on the rocks clumps of corals and sprigs of *Gorgoniæ*, and down deep in this shady corner place a big hemispherical Astræan. Here among the sea-weeds, and just out of reach of the sunbeams, let us plant two or three softly-tinted sea-anemones, just where the translucent, tender, petal-like tentacles of these sea-flowers will be best shown off. And we must not forget to stock our aquarium with a plenty of sea-urchins, pincushiony little monsters, bristling all over with long dark purple spines (*Echinometra Michelini* Desor), and each nestled comfortably away in a cavity worn in some incomprehensible manner in the solid rock. Here is a little crimson star-fish (*Echinaster*) ;* let us half hide him in under the sea-weeds, for it won't do to make him too conspicuous; and here are some queer crabs, that go restlessly prying about among the sea-weeds, frightening the sea-anemones, and, perhaps, falling a prey to a snaky-armed cuttle-fish, that lurks under some dead coral. Now we must introduce a

* *Echinaster crassispina* Verrill. Rays short, somewhat angular. Radius of disk .5 of an inch; of rays 1.9. Spines along each edge of the ambulacral grooves in two rows, the outer ones large and sharp, crowded, those on opposite sides crossing one another, a single one on each plate. Spines of inner row much smaller, not half as long, one to each plate. Lower side of ray with a row of distant, large, conical, sharp spines, not extending upon the disk. On back and side of rays there are four or five other irregular rows of similar large, sharp spines, rising from the swollen nodes. It has shorter and more angular rays, coarser structure, larger and fewer spines than *E. spinosus* of West Indies.

swarm of little, gaily-painted, gilded and silvered fishes, and a crystal jelly-fish; a host of little shells, half of them tenanted by hermit-crabs, and swarms of little crustaceans. Now we will wreathe in among the sea-weeds, here and there, the necklace-like, pearly body of a marine worm, and we shall then have an aquarium, wonderfully like those which nature has so liberally strewn over the surface of the Brazilian coral-reefs.

Under the dead corals one finds great numbers of a large *Ophiura*, with a small disk-shaped body, and long snaky arms (*O. cinerea* Lyman), and by dint of a little patient examination, with the aid of a pocket lens, he may collect hundreds of species of animals from one of these pools alone. At the Abrolhos Islands, I found a few specimens of a large, almost pentagonal starfish, which is very common in the West Indies (*Oreaster gigas* Lütken). This also occurs at Bahia, together with a very well-known West Indian shell, quite common as a mantel-piece ornament, and which has the misnomer of *Cassis Madagascarensis!*

The corals, which go to make up the Santa Barbara reef, are principally *Acanthastræa*, *Heliastræa*, *Siderastræa*, *Favia*. *Porites*, *Millepora*. The reef-rock, like that of the reefs, is a compact, hard, white limestone, which appears to show scarcely any organic structure. The corals are so broken and cemented together, that their structure is quite obliterated. The Santa Barbara reef, then, forms a wharf-like structure, partially surrounding the island. It has grown upward as far as possible, *i. e.* to a level a little above that of low tide, when the corals having died, further growth is stopped. It varies much in width, but in some places it reaches even 400 feet. At the south-west extremity of the island there is a little islet, composed of a pile of boulder-like masses of trap, and known as the "Cemetery," which at low tide is united to the main-land by this reef. A reef of the same kind is formed around part of the neighboring island of Redonda, and Siriba also has one.

THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.*

BY SIDNEY I. SMITH.

It is one of the ever-wise provisions of nature, that every land has a vegetation and an association of animals peculiar to itself, that every sea and every zone of ocean is peopled with life found nowhere else. There is such a wealth of conception in the forms of organic life, that there is no need of their repetition in distant lands. The palms and the reef corals never wander from the tropics; the humming-birds are as peculiarly American, as the Mississippi or the Andes. It is specially the province of modern science to explain the phenomena of nature on known natural laws and forces, and with this view no phenomena are more interesting than those of the geographical distribution of species. The subject, in its full extent, would involve a solution of the much-vexed question of the origin of species; but whether species now living were derived from their relatives of a former geological age, or were independently created, we will not question in the present article, only taking species when they first appeared as they now exist, and contenting ourselves with some of the more prominent forces which bind them to peculiar habitats, or tend to diffuse them over wider or different areas.

These secondary causes, which act in the geographical distribution of species, are either inorganic or organic. Of the former the most important are the influences of topography, temperature, ocean currents, winds, and humidity; of the latter, animals themselves, and man,—for in this respect man must be separated from the mere brute animals as wielding a very different influence. The inorganic forces are so interwoven, they so act and react upon and limit each other, that

* "The Influence of Secondary Causes in the Geographical Distribution of Animals;" one of the subjects assigned for essays for the Berzelius prizes in the Sheffield Scientific School of Yale College in 1867.

they can scarcely be treated singly, and their influences are therefore discussed together; but the laws which govern the distribution of animals in the ocean are so different from those which govern the distribution of land and fresh-water species, that they are best treated separately.

The influence of topography in limiting the diffusion of marine species is too evident to require much explanation, and yet, uncombined with the influence of temperature, it would have little effect; for it is hardly possible to imagine a limit to the migration of species along coast lines and around capes from ocean to ocean, were the temperature of the water perfectly uniform. Still the mere separation of coasts by long intervals of deep water seems to have a direct influence in preventing the migration of certain groups of species; as, in the Pacific Ocean, under the same lines of temperature,* there are many species, especially of fishes and polyps, which are peculiar to each of the great groups of islands.

The influence of temperature has long been recognized as a most powerful cause in limiting the diffusion of marine species. Animals, with very few exceptions, are adapted for life and reproduction only within fixed limits of temperature, and a rise above or a fall below these limits, quickly puts an end to their existence. Such limits of temperature act as a continual check upon the effects of ocean currents in transporting species from place to place. Thus the Gulf Stream, flowing from the warm coral reefs of Florida and the Bahamas, must bear myriads of life-germs to the Bermudas and on across the Atlantic toward the Azores; but the isocrymal line of 68° F., which limits, on both sides of the equator, the reef-building corals† and most of the tropical

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*The fact should not be overlooked that these isothermal and isocrymal lines indicate only surface temperature, and as there is yet very little known of deep ocean temperature, that it is quite possible that some species are retarded from descending to a sufficient depth to pass from place to place by the decrease in temperature; still the number of species must be small that can exist, even with the same temperature, at very different depths. (*Isothermal* is used to express equal annual temperature; *isocrymal*, equal temperature for the coldest month of the year.)

† Dana, United States Exploring Expedition, Vol. I, Zoöphytes.

marine species,* passes just north of the Bermudas, and all the germs of tropical life that cross this line must perish. The marine fauna of the West Indies extends to Bermuda, but, arrived at the Azores, the winter temperature has fallen to less than 60° F., and we have the fauna of the Mediterranean and none of the characteristic Bermuda species. On the other hand, in the Pacific, where the equatorial current flows continuously within the isocrymals of 68° north and 68° south, there are many species of mollusks, crustaceans, and echinoderms found from the Sandwich Islands to the coast of Africa, or through half the circumference of the globe.

The mere intervening deep ocean, without connecting islands, might prevent the occurrence of some of the Bermuda species at the Azores, as in the corals, the young of which probably cannot exist very long without becoming attached; but even along continuous coast lines, very few species extend through marked changes of temperature. On the western coast of America, a large part of the mollusks, crustaceans, echinoderms, and some polyps, extend from Lower California to Guayaquil and a few to Paita, Peru, but very few species are common to Guayaquil and to Callao, only a few hundred miles farther south. The isocrymals of 62° to 68° F. all converge near Cape Blanco, and such a change in temperature prevents the interchange of species between places north and places south of this point.†

The insular faunal character of the Americas has been remarked by many naturalists,—most of the marine species of

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* Among the Crustacea, excluding the little known Entomostraca, Dana found, out of 1,036 species in the faunal torrid zone and 924 in the temperate zone, only seventy-five common to the two.—U. S. Expl. Exp., Vol. XIII, p. 1527. As the range of species becomes better known, the proportional number of species common to the two zones will undoubtedly be increased, but the fact is sufficient to show the great influence of temperature in limiting the diffusion of marine species.

† Many of the Peruvian, and some Panamic species, are found at Paita, and as usual there is a blending of the two faunæ at their junction; but this blending does not extend a great distance along the coast, and is what would be expected from the warm waters overlapping the colder. If there are species which have their centre of greatest development and abundance near the border of a fauna, it is nothing more than might be expected from the effects of temperature,—such species being adapted to a temperature intermediate between that of two faunæ.

both coasts belonging to peculiar American types,—and yet the shores of America are connected by zones of equal temperature with the Central and Western Pacific, and with the eastern shores of the Atlantic. How is this peculiar American character preserved? What prevents the interchange of species, if temperature is the great cause which limits their distribution? A glance at the ocean currents shows that none of them leave our shores without undergoing a marked change in temperature, and that none, from other shores, arrive upon them without undergoing a similar change. The Gulf Stream, after leaving the coast of the Southern States and the Bermudas, changes its temperature from 68° F. to 60° before its southern outflow reaches the Azores, and to almost 50° before it arrives on the shores of Europe. The Atlantic equatorial current is formed off the coast of Africa by the union of the returning Gulf Stream, flowing from Southern Europe and the Azores, and the northern current flowing from Cape Good Hope. These currents flow directly from temperate coasts into the torrid zone, which, by their influence, is narrowed down, on the western shores of Africa, to 20° of latitude, while on the American shores it extends through 60°. The antarctic current from Cape Horn flows northward into the warmer waters of the southern Atlantic. The antarctic polar current of the Pacific comes north from the frigid regions of the south into the temperate waters, is bent eastward against the shores of South America, and the principal branch flowing north along the coast is turned westward from Cape Blanco or Punta Parina, and, under the equator, still retaining the low temperature of the southern waters, sweeps into the torrid regions beyond the Galapagos. The current, flowing from the north along the western shores of the United States, leaves the coast of California and flows southward into the tropics. The frigid regions of North America are, of course, excepted, and the arctic American partake strongly of the character of the arctic species of the old world.

How beautifully these material forces act, binding each species to a special home, from which it may not wander and live. Nature places the bounds, the ocean waters may sweep by, but they cannot bear along the life which throngs them. These inorganic causes alone constitute the limits of faunæ, and can it be doubted that faunæ really exist in nature, when it is fully understood that all their modifications and complications are results of revolutions in these causes themselves? Let us look at some of these revolutions,—changes in topography, in temperature, and in ocean currents,—for thus far we have seen only how the diffusion of ocean species is limited by secondary causes.

We should begin when the first species of the present faunæ began to appear, and trace the changes to the present; but the data are very imperfect, and we can get only glimpses of these changes, yet enough to indicate some of the effects they have produced in the distribution of species. There is some uncertainty how far back in geological time species now living may have existed, but most authorities agree that at least a few of the present marine species were living in the Tertiary period, when Europe was scarcely more than an archipelago, when the lower Mississippi valley was a part of the Gulf of Mexico, and while Florida and the whole border of the southern Atlantic States were still swept by the waters of the ocean. But these few recent species were not then in their present homes; they have wandered, like the early races of men, southward.

The European fossil land faunæ and floræ indicate very clearly a change of climate from tropical to temperate during the Tertiary period, and in the marine climate there was a similar change. On the western shores of France, along the vallies of the Loire and the Ardour, there are deposits of early Tertiary mollusks and echinoderms, a large part of them extinct or unknown species, but a small part at least are still living in the Atlantic Ocean. These species are not, however, now found on the coast of France, but eight

or ten degrees farther south on the coast of Africa, and all the species of these ancient deposits partake of what is now a more southern character.*

During the Tertiary period there was a gradual but very extensive elevation of the northern part of the continents. It was during this period that the Alps and the Pyrenees were raised to their present level. The lifting at the north of such masses of land into the cooler regions of the atmosphere would have had a powerful influence in reducing the temperature of the neighboring seas. As the waters became slowly cooled, the species best adapted to migrate gradually extended their limits southward; on the north, the species were destroyed by the advancing cold, and all those species with little power of migrating, and those easily affected by changes of temperature or other physical causes were wholly exterminated. And thus, on the shores of Africa, still exist the remnants of the ancient Tertiary fauna of the southern European seas, driven from their former home by the advancing cold, but living on through all the changes, even of a Glacial epoch.

In North America, the land climate during the early and middle Tertiary was warmer than now, as is indicated by the plants of the lignite beds, and the marine climate undoubtedly corresponded with that of Europe and with that of the land. In the northern parts of the country no fossil records of the later marine Tertiary are known, but the land faunæ of the period, the upheaval of the northern parts of both countries, and the changes in the European seas show very clearly that there were similar changes on the American shores.

The arctic marine fauna of the earlier Tertiary, while much more land than now was submerged at the north, must have been circumpolar in character, and the retreating of species southward from this common point accounts for the occurrence of the same species on the northern coasts of both

*Forbes, Natural History of the European Seas.

continents. Even those few species which are common to the temperate regions of both oceans or the shores of both continents, and not now found in the intermediate northern regions, may have been driven in the same manner southward, until the intervening continent or ocean left the remnants of the old circumpolar fauna widely separated in more southern regions. Why call to the aid of modern theories the mythical Atlantis to bear species across the ocean, when known climatic changes can have led them gradually from a common home at the north?

The marine fossils of the latest Tertiary of Europe, and doubtless of North America also, are very largely living species;* and at that time, the climate of the North Atlantic was nearly like that of the present. In the absence of any knowledge of fossil deposits contemporaneous with the earlier Glacial period, it is impossible to arrive at any definite conclusions in regard to the geographical distribution of the species at that time.† Still, the number of species which continued to live on through the Glacial epoch, the absence of well marked and extensive glacial phenomena from middle latitudes, and the appearance, in the decline of the Glacial period, of species near their present habitats, are good negative evidence that there was no very extensive southern migration of marine life during that period.

Darwin, in the "Origin of Species," supposes the cold of the Glacial period sufficient to have driven the species from the arctic and from the antarctic to the equator, and thus accounts for the similarity of the living species of those regions. Such intense cold would have been sufficient to destroy all life in the North Atlantic; and it can scarcely be supposed that species would travel from far north to the

* Lyell gives the proportion of living species of shells found in the Norwich Crag, in England, as ninety per cent. or more.—Principles of Geology, Amer. Edit., p. 143.

† A careful investigation of the later Tertiary of the Southern States, and its comparison with the Post-tertiary, would throw much light upon the extent of the disturbances in the geographical distribution of species in the North Atlantic during the true Glacial epoch.

equator and back again without leaving some traces behind them. Nor are the faunæ of the arctic and of the antarctic so closely allied as has sometimes been supposed. There is no well-authenticated instance of the same animal species occurring in each of the frigid latitudes, except such as have an intermediate or cosmopolitan existence.*

As Dr. Packard † has shown, the submerged beaches give very good evidence that the boreal and arctic regions of North America during the true Glacial epoch, stood at a much higher level above the sea than at present. This elevation was undoubtedly enough to raise the submerged border of the continent, the Gulf of St. Lawrence, the Banks of Newfoundland, and the banks off the coast of Nova Scotia, Maine, and Cape Cod, above the sea-level. As the rise and enlargement of the lands at the north during the Tertiary period had changed the climate of Europe and the northern parts of North America from tropical to temperate, this elevation during the Glacial epoch must have changed the climate of these regions from temperate to frigid, and brought the snow line down to the coast of New England. Such an enlargement of lands at the north would not, however, change materially the climate of the tropics, and it is altogether probable that the Gulf Stream flowed on and warmed the southern coast as it did in the Tertiary and does now, and that the coral reefs of Florida and the West Indies were then slowly building beneath its warm waters.

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* Professor Lilljeborg, in a recent paper (noticed in the NATURALIST, p. 48), in the Trans. Scientific Soc. at Upsala, on the *Lysianassa Magellanica* Milne Edwards, and on some other Crustacea of the suborder Amphipoda, on the coast of Sweden and Norway, while admitting that no species had previously been found common to both frigid zones and not in intermediate localities, claims to have discovered, in a gigantic Amphipod living upon the coast of Norwegian Finmark, the *Lysianassa Magellanica* of Milne Edwards. Bate has shown, however, in the Zoölogical Record for 1865, p. 330, that the arctic species is not only specifically distinct from the *Lysianassa* of Milne Edwards, but that it cannot be referred to that genus. Such facts show how very difficult it is to prove the identity of animals from far separated localities, without a direct and careful comparison of specimens, and how little confidence can be placed in the reported identity of such animals.

† Observations on the Glacial Phenomena of Labrador and Maine. Memoirs Boston Soc. Nat. Hist., Vol. I, Part II. Many of the facts, on several succeeding pages, are drawn almost wholly from this very interesting paper.

The sinking of the lands which closed the true Glacial epoch, carried the coast line higher than it is now, as is shown by the fossil deposits of the Leda Clays (Champlain epoch), found along the coast and far up the lower vallies from Labrador to New York. It might at first be supposed that such a depression would induce a climate even warmer than the present; but a depression of six or seven hundred feet would have made islands of New England and Nova Scotia, and opened a way for the Labrador current from the Gulf of St. Lawrence into the Bay of Fundy and along the coast of Maine, and, at the same time, would have allowed a branch of the current to flow up the valley of the St. Lawrence River into Lake Champlain, and very likely down the valley of the Hudson. Such a surrounding flood of arctic waters would have reduced the summer temperature of the land, and carried the arctic marine species somewhat south of their present limits.

The species left fossil in the Leda beds confirm this, and show very accurately the distribution of marine life at the time these beds were formed. The species of the earlier Labrador beds are more purely arctic than the present fauna of that coast.* The beds of fossils at Portland and Saco indicate that the Syrtensian fauna extended into the mouth of the ancient Casco Bay, as it now does into the mouth of the Bay of Fundy. At Point Shirley, in Massachusetts Bay, the species of the Leda beds belong almost exclusively to the Virginian fauna, which is now found only south of Cape Cod.† This shows that a branch of the Gulf Stream flowed over the eastern end of Long Island, and across submerged Cape Cod, into Massachusetts Bay. Thus, since all, or nearly all the marine species which now inhabit our coast were in existence, arctic species extended into southern Maine, and species, now living only south of Cape Cod, extended north to Cape Ann. The southern outliers of the Syrtensian

* Packard, loc. cit., p. 234.

† Stimpson, Proceedings Bost. Soc. Nat. Hist., Vol. IV, p. 9, 1851.

THE HAIRY MAMMOTH.

and Acadian faunæ, on the deep water-banks off the New England coast, are thus shown to be relics of the northward migration of these faunæ.—*To be concluded.*

THE HAIRY MAMMOTH.

BY A. S. PACKARD, JR., M. D.

IN 1799, Schumachoff, a Tungusian hunter, discovered at the mouth of the river Lena a shapeless mass frozen in the ice. But not until two years after, 1801, when the ice had so melted that the tusks and one side of the animal were disclosed, did he know upon what a monster he had stumbled. Returning to his home on the borders of Lake Oncoul, he told his family of the strange creature entombed in the ice. They were seized with consternation, for in the days of yore some hunter had found on this peninsula the same sort of animal, and his family had all died soon afterwards.

Death, however, did not invade the household. The god of mammon reigned instead. On recovering from the nearly fatal sickness into which his superstitious fears had thrown him, our enterprising ivory-hunter, led on by the greed of gain, revisited the Mammoth Golgotha, and in March, 1804, favored by the warm weather, beheld the gigantic carcass, now become historic, reposing free from its icy tomb on the sands of the Lena. He sold the tusks for fifty roubles, and the carcass was left to the tender mercies of the people about, who fed their dogs on the flesh, while "wild beasts, such as white bears, wolves, wolverenes, and foxes also fed upon it, and the traces of their footsteps were seen around." The skeleton remained entire, except one foreleg, which some unusually enterprising white bear probably lugged off. Professor R. Owen, whose account we have been using, states that,—

"According to the assertion of the Tungusian discoverer, the animal was so fat, that its belly hung down below the joints of the knees. This mammoth was a male, with a long mane on the neck; the tail was much mutilated, only eight out of twenty-eight caudal vertebræ remaining; the proboscis was gone, but the places of the insertion of its muscles were visible on the skull. The skin, of which about three-fourths were saved, was of a dark gray color, covered with a reddish wool, and coarse long black hairs. The dampness of the spot where the animal had lain so long had in some degree destroyed the hair. The entire skeleton, from the fore part of the skull to the end of the mutilated tail, measured sixteen feet four inches; its height was nine feet four inches. The tusks measured along the curve nine feet six inches, and in a straight line from the base to the point three feet seven inches.

"Mr. Adams collected the bones, and had the satisfaction to find the other scapula, which had remained, not far off. He next detached the skin on the side on which the animal had lain, which was well preserved; the weight of the skin was such that ten persons found great difficulty in transporting it to the shore. After this, the ground was dug in different places to ascertain whether any of its bones were buried, but principally to collect all the hairs which the white bears had trod into the ground while devouring the flesh, and more than thirty-six pounds' weight of hair was thus recovered. The tusks were purchased at Jatusk, and the whole expedited thence to St. Petersburg; the skeleton is now mounted in the museum of the Petropolitan Academy."*

The Mammoth (*Elephas primigenius* Blum.), did not dwell alone in Siberia. A hairy Rhinoceros (*Rhinoceros tichorhinus*), which had a length of eleven and one-half feet, was found frozen in Siberia near Wilui in 1777. It ranged from England and Middle Europe to Siberia. Like the living species of elephants, the Mammoth not only browsed on the leaves of the spruce and fir, but ground beneath the broad surfaces of its immense grinders boughs of considerable thickness. It has been objected, despite its hairy coat, fitting it for the rigors of a Siberian winter, that the Mammoth could not have been indigenous to the shores of the Arctic Ocean, since the vegetation was so scanty; but Professor Owen sets aside such objections, observing that "forests of hardy trees and shrubs still grow upon the frozen soil of Siberia, and skirt the banks of the Lena, as far north as latitude 60°. In Europe, arboreal veg-

*Owen's British Fossil Mammals and Birds.

etation extends ten degrees nearer the pole, and the dental organization of the Mammoth proves that it might have derived subsistence from the leafless branches of trees, in regions covered during a great part of the year with snow."

We may, with this learned author, assign the northern limit of trees, which even at some points reaches the seventieth parallel of latitude, as the bounds to the wanderings northward of the Siberian Mammoth. A few years previous (1796), Cuvier announced that the bones of elephants found scattered through the Quarternary deposits, or Post-tertiary sands and clays, and the upper Tertiary deposits, belonged to a distinct, as well as extinct species. This fact suggested to him the idea of the existence of former worlds and successive creations of species, and from this moment the science of Palæontology took its place in the sisterhood of sciences. The bones of the Mammoth and the mastodon, the rhinoceros and hippopotamus were shown to belong to extinct species which formerly roamed over the surface of Southern and Middle Europe, and not, as his opponents contended, of luckless inmates of Roman menageries, or less likely, as others alleged, of heathen giants sixty feet high, who lived in the age of fable.

Organized research, led by the great French Palæontologist, established the fact that the Mammoth was indeed once an abundant animal in Europe. This huge elephant, with its cousin, the mastodon (*Mastodon angustidens*), a still larger genus of elephants, differing in the structure of the teeth, was common in Middle and Southern Europe; the species of both genera, like the elephants of the present day, enjoying a wide geographical range. The Mammoth ranged from the fortieth to the sixtieth parallel of latitude.

Lartet, one of the founders of a new science, *Anthropology*, has brought forward additional proof of the former existence in Middle Europe of the Siberian Mammoth, and that from the most startling sources.

In May, 1864, this French geologist, with his countryman

Vernueil and an English naturalist, Dr. Falconer, visited the caves of Perigord in the department of Dordogne, France, and discovered, in the soil and debris in the bottom of these caves, various sketches of animals carved on pieces of deer's horns and elephant's ivory.

We copy from an account of the discoveries made by Lartet and Christy (prepared by the great Danish naturalist and archæologist, Professor J. Steenstrup, for a Danish Natural History Journal, published at Copenhagen),* drawings that rival in interest the Rosetta Stone, specimens of Egyptian and Assyrian sculpture, or the remains of Aztec art. Fig. 1

Fig. 1.

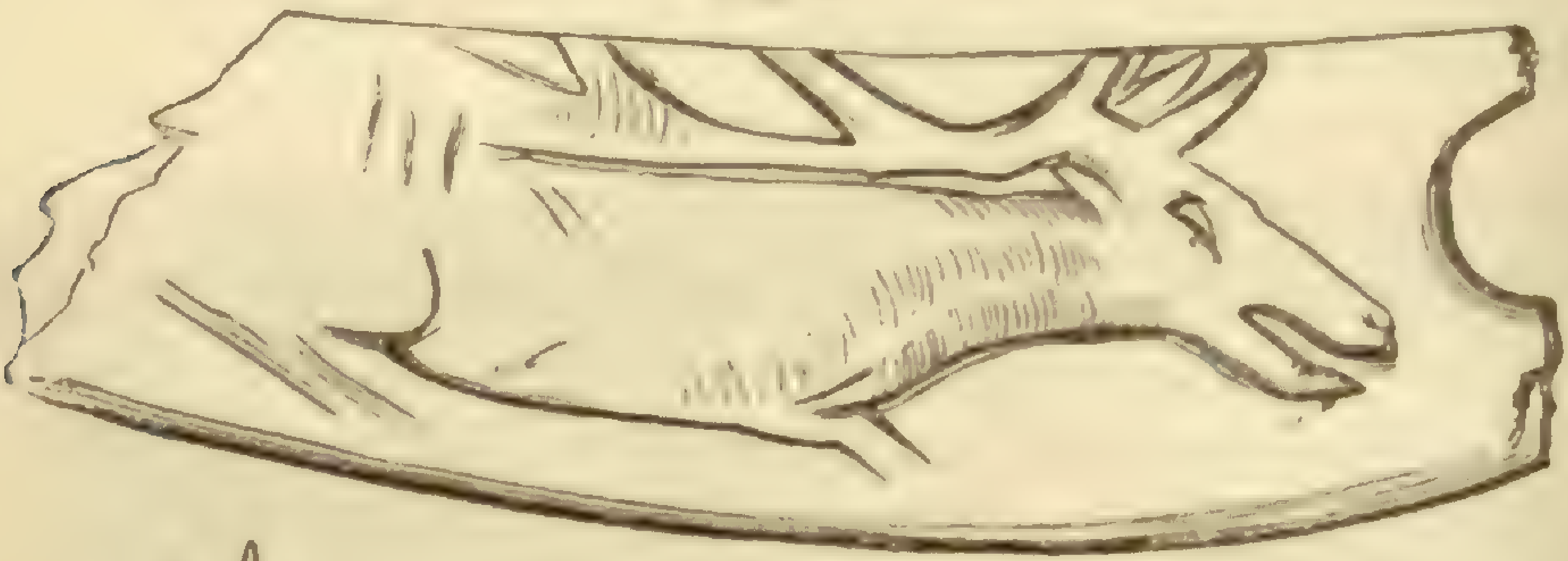

Fig. 2.

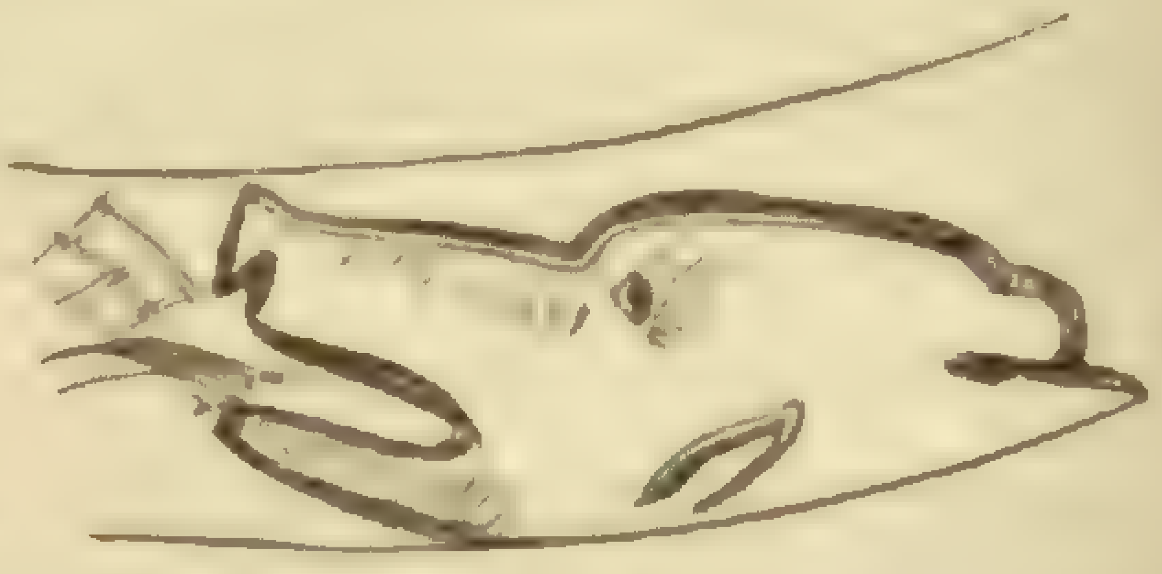

Fig. 3.

represents a species of deer, probably the reindeer; Fig. 2 an elk, allied to our moose; and Fig. 3 unmistakably pictures the head of the wild boar. The reader may puzzle over Fig. 4, but let him compare it carefully with the restoration of the Hairy Mammoth (*Elephas primigenius* Blumenbach, Plate 1),† which has been recently published by the Russian naturalist Brandt, from which our drawing is a little re-

* Tidsskrift for populaere fremstillinger af Naturvidenskaben, Udgivet af C. Fogh og C. F. Lütken. 3d ser., Vol. IV, Kjöbenhavn. See also our account of these discoveries, Vol. I, p. 274, taken from the Quarterly Journal of Science, London.

† Figure of a Hairy Mammoth engraved on a piece of elephant's ivory, found in the Madelaine Cave in the department of Dordogne, France. Taken from a photoxylo-

Fig. 4.

Figure of a Hairy Mammoth engraved on a piece of elephant's ivory, found in the Madelaine cave.

duced, and lo, an off-hand sketch of his trophy of the chase by some prehistoric Cummings or Baker!

As specimens of earliest art they are certainly creditable, and almost rank with drawing of animals represented in Assyrian, Egyptian, or Aztec art, at least surpassing the hieroglyphics of the North American Indians. The peculiar shape of the head of the Siberian Mammoth, with its characteristic up-curved enormous tusks, and trunk hanging down at ease, and the hairy mane, which no living species of elephant possesses, evince a quick eye, excellent perceptive powers, and an artistic touch given by the prehistoric artist, which certainly discovers the germs of dawning art in the Cave-dwellers of France.

From portions of several skulls and a single lower jaw of man found in the caves and gravel-beds of Europe, anatomists of high authority have, we cannot but think too hastily, referred their possessors to the most degraded of savage races.*

The bas-reliefs and inlaid sketches of our cave-dwellers, rather ally them, from the evidence of their art-remains, as a very high authority, Professor Steenstrup suggests, to the tribes of Eastern Asia. He states that Chamisso, the Italian

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graphic copy, published in the Danish Popular Journal of Natural History, reduced one half, from Lartet's original drawing.

About the same time the Marquis Vibraye discovered, on the banks of the Vésère in Dordogne, another engraving of the Mammoth made in a slab of slate. In speaking of the accuracy of the sketches he says, "The artists of the Augerie have made no caricatures, and dealed little in the fanciful. If the rough sketches of art in its first steps seem to us rude, the truthfulness of the general forms are shown to be at least scrupulously respected. I will cite as an example a slab of slate on which there is reproduced with a few strokes a combat of the reindeers. The victor is represented in an attitude the truthfulness of which is surprising. It is the same with an engraving of the head of the reindeer obtained also in one of the stations of the Augerie. In view of such facts it seems to be inadmissible to suppose, that, in making a purely fanciful drawing of a head, an aboriginal should have precisely reproduced that of an elephant, by the side of which we have constantly found the remains in the same conditions of burial: and that blind chance had been a sufficient guide for him to give in his sketch all the characters of a proboscidian of whose existence he was ignorant."—Annales des Sciences Naturelles, 5e ser. T. 4, p. 361. 1865.

* Maligned as these primitive folk have been by certain savants and popular-science writers, the unkindest blow of all has been dealt by the Rev. D. I. Heath in the London Anthropological Review, April, 1867. Readily accepting the supposed ape-like form of this race, he gravely propounds the theory that the "Kitchen-middeners" were *mutes*,

traveller, describes in his "Voyages," the expertness of some tribes of North-eastern Asia, in drawing figures of animals on walrus tusks and the teeth of the sperm-whale.

In an evident zeal to make these people a connecting link between man and the apes, have not some writers exaggerated, on rather slight data, the degraded and savage character of these primitive folk?

Have not geologists also exaggerated the geological age of the Stone period, carrying it too far back, and also not bringing it near enough to historic times? In the first flush of the interest excited by these startling developments, they also have demanded too great a cold for the climate of Middle Europe. Associated with these Mammoth bones and drawings were sketches of an animal like the Irish elk, which historical evidence tends to show existed up to the fourteenth century; of the reindeer, which Cæsar refers to in his Commentaries, which Boyd Dawkings thinks must have lived in Northern Scotland as late as the twelfth century, and which remained in Denmark up to the sixteenth century; of the bison, which still survives in Lithuania, the urus, aurochs, or *Bos primigenius*, which is said to have lingered in

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who were taught to speak by men of the Aryan race who shared the land with them, or, as the December number of Blackwood has it,—

"Anthropologists say, after man had his birth,
There were two human races possessing the earth;
One gifted and graced with articulate speech,
And another that only could gabble and screech.

The Aryans could speak, and could build, and could plough,
And knew most of the arts we are practising now;
But the Dumbies that dwelt in those vile Kitchen-middens,
Weren't fit but to do their superior's biddings.

So an Aryan went forth to enlighten these others,
And to raise them by speech to the level of brothers;
On the Mutes of the Middens he burst with eclat,
And attempted to teach them the syllable PA."

The rather infantile science of the Anthropological Review, put into easy verse, does not state whether Aryan implements and relics have been found in the Kjœkenmœddings. But thus far has any evidence of an intermixture of two races, one so much higher than the other, been found in Denmark during the Stone Age? We shall wait patiently for a few pertinent facts; meanwhile, in these days of equal rights, advocating Kjœkenmœdding suffrage; believing that they were born with all their senses and faculties such as they were, and stood on the same level with their Finnish and Lapland allies or representatives of later times.

Switzerland up to the sixteenth century, and the wild boar, still abundant in Central Europe.

The Mammoth, then, was hunted in middle Europe by a hardy race of men (the Reindeer Folk), savage, it is true, but who wielded the spear, and shot flint-headed arrows at the enormous beasts they hunted; and, resting from the fatigues of the hunt, engraved on ivory* the animals slain by them with a sort of hard-pointed style; whose wives probably made garments of skins sewed with delicate bone needles, and whose families seemed to have been well housed

*"In the working of bones, especially the antlers of the reindeer, these Reindeer men seem to have excelled. Lance and arrow-heads with barbs, knives, and daggers, all kinds of flat and curved shapes apt for scraping the skins and similar objects, awls and needles of considerable fineness, with eyes fit for the passage of a thread; handles are found in quantity, and some unfinished specimens show the troublesome mode by which these implements were brought to a finished condition.

"The art products of the Reindeer people who inhabited France are of particular interest. The decorations on many pots and implements, consisting of simple, straight, angular, or crossed lines, exhibit a certain sense for beauty; but the drawings of animals, as discovered by MM. Lartet and Garrigou, are still more surprising. They are mostly found engraved on bones, but also on slate. Those found by M. Garrigou represent heads and tails of fishes; those in possession of M. Lartet represent large mammals, among which the reindeer is easily recognized by the antlers. Most of these drawings occupy, certainly, merely that rank in art as a schoolboy's attempts on the wall, in order, as a little nephew of mine observed, to derive pleasure from its contemplation. Many of these drawings only furnish us with the idea of horned ruminants in general, leaving to our choice to detect the difference between oxen, sheep, and goats; others, however, are sufficiently characteristic to enable us to recognize the animal at once, although the proportions are somewhat faulty. The masterpiece in Lartet's collection is a handle carved from the antlers of a reindeer, a real sculptured work, the body of the animal being so turned and twisted, that it forms a handle for a boy's hand. All other drawings are in sharp and firm outlines, graved upon the surface of the bone, and it may be seen that the artist, in working it, turned the bone in various directions, some of the lines showing a flat inside turned surface. Many of these drawings are known to the public by the treatises of Lartet and Christy on the caves of Perigord; but I can, from my own inspection, assert that there exist in that collection many others, and these highly characteristic. Thus I recently saw in my friend Desor's collection two plaster casts of pieces found in a heap of bones of the Reindeer period, at Madelaine, near Tursac (Dordogne). It is a kind of kitchen-midden at the foot of a rock, about fifteen mètres long, seven mètres broad, and two and a half mètres thick. In the middle some human remains were found. One of these pieces is a broken-off femur of a swan. The animal carved upon it has a short thick tail, a long straight back and belly, the head and the lower parts of the feet are wanting; a zig-zag line along the back, imitating somewhat rudely the aspect of the reindeer in summer, when the long winter-hair still hangs in flocks about the back, whilst the belly shows already the short dark summer hair. Some short lines before the forefeet may represent the hair of the throat. The second is a fragment either of a femur or a tibia. It represents two reindeers following each other (?), the one being known by its indication of antlers. Further explorations will, no doubt, increase our treasury of art products of the reindeer period."—(VOGT.)

in caves and rock-shelters and rude huts, at a period long before the first dawnings of history.

So far from being lower than Australians and Hottentots, they may have been the ancestors of the Calmucs and Fins and Lapps. Living near glaciers which descended into the plains of France down the slopes of the Alps and Pyrenees, which brought Alpine and ice-inhabiting animals close to their hunting-grounds, they yet chased the boar through the forests, the elk through the morasses and grassy intervals, and pursued the musk-ox, the roe, the chamois, ibex, Pyrenæan deer, and, most abundant of all, the reindeer, over the snow-fields lying on the hills and uplands; and in the lower plains and valleys watched by night, made hideous by the cries of the cave-hyena, for the Mammoth and mastodon, the cave-bear, the lion, tiger, and tichorhine rhinoceros, as they came from their retreats to slake their thirst at the river bank.

Professor Carl Vogt, in "The Primitive Period of the Human Species," translated for the Anthropological Review, has given the most recent and more moderate views regarding the Stone Folk. With Lartet and Christy he divides the Stone Age into two periods: first, the "*Cave-bear epoch*, distinguished by large, now extinct, species of beasts of prey and pachydermata, rude flint implements, coarsely worked bones, and long cranial forms of a strong race of men;* and second, the *Reindeer period*, characterized by the

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* "In endeavoring, from the discoveries hitherto made, to form conclusions respecting the civilization of this long-headed (inferring from the Neander skull), powerful, tall, and strong primitive man, who lived by the side of the cave-bear and the mammoth, we perceive that already then he honoured his dead by burying them, probably in a crouching position, in grottoes closed with slabs; and that he furnished them with meat and arms for their journey into another world. He knew the use of fire, and constructed hearths, where he roasted his meat: for of pottery the traces are but few. He broke the long bones of the larger animals in a systematic manner, in order to extract the marrow; and also the skull, to obtain the brain. His implements or weapons consist of rude hatchets and knives, which were struck off from a flint block by another stone; and of worked bones, employed for handles, arrows, clubs, or awls. Such pieces as look like pike or arrow-heads never show any grapple-hooks, but smooth sides. This wild primitive man, the wildness of which is indicated by his terrible superciliary arches, nevertheless endeavored to ornament his person with perforated pieces

northern fauna of a cold climate, by hammered stone weapons, carved and artfully decorated bones, and the short skulls of a small and more delicately constructed, but, at all events, a very intelligent art-endowed race of men."

But is it not possible that the two races lived contemporaneously? The Reindeer Folk may have inhabited the upper valleys and hills near the Alps and Pyrenees, which send spurs into Southern and Central France. They were, perhaps, mountaineers, and the animals associated with them, and most characteristic of the period, were alpine and northern species. Like the Lapps and Fins, the men were dwarfed, and more delicate, and perhaps more active-minded and ingenious than the Flint Folk. So far from dwelling exclusively in caves, they may have lived in skin lodges in summer, and in wooden or snow huts in winter.

Their neighbors, the Flint Folk, or Lowlanders, a taller and stronger race, meantime inhabited the plains of Northern France and Belgium, England and Germany, and the fauna was made up of the Mammoth, mastodon, and rhinoceros, horse, cave-bear (which was much more abundant than with the Reindeer people), bison, aurochs, and deer, which inhabited the more genial and fertile plains.

Taking this view, the supposed great length of the Stone Age is much reduced; it explains how two such dissimilar races lived side by side, just as the Lapps and Fins lived twenty centuries since, not far from the Celts and Tartars, on the mountainous parts of Europe and the borders of Asia; and while the climate was colder on the highlands, on the plains of Middle Europe it was, probably, much as described by Tacitus and Cæsar.

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of coral and the teeth of wild animals. He probably dressed in skins or prepared bark of trees; for the awls and needles found may have been serviceable for patching together such materials, but not for weaved stuff. We possess no direct information respecting his food, besides that he procured from the chase. The great number of flint instruments found in the caves, since attention has been drawn to this subject, lead us to infer that this man had spread over the whole of Central Europe this side of the Alps; whether in a single or various types, will only be decided when we are in possession of a greater number of skulls."

In our own land the Mammoth was associated with the *Mastodon giganteus.* Herds of the Siberian Mammoth found their way across Behring's Straits into Alaska, as their remains occur in the greatest abundance at Eschscholtz Bay. The explorations of Mr. W. H. Dall show how common it must have been to the southward in the Yukon Valley. It seems to have extended southward in America as far as the parallel of 40°, as remains, found at several localities in Canada, have been referred to this species.

Professor Leidy has claimed, on partial evidence (a complete skull not having yet been found), the existence of a truly American species of elephant (*Elephas Americana*), representing in the new world the European and arctic Hairy Mammoth. This species replaced, in the warmer parts of our country, the Siberian elephant. Its remains, like those of the mastodon, are found at the bottom of swamps and in the upper strata of river sands. It should be borne in mind by the reader, that these deposits of river alluvium are the most recent of the deposits of the post-tertiary age. They should not be confounded, as they often are, with the true glacial or drift deposits, which were thrown down at an immensely earlier period, so far as known facts teach us. In the Northern States, at least, we had the following succession of events antedating the appearance of the American elephants,* including the mastodon, though this does not preclude their existence southwards, where the climate was hotter. The warm climate of the latest Tertiary (Pliocene), in which the temperature of New England and the Northern States may have been like that of the Gulf States at the present day, gave way to the arctic cold that brought with it the snows and glaciers of the true Glacial epoch, the period which separates the Tertiary from the Quarternary

* "The American elephant ranged from Georgia, Texas, and Mexico on the south, to Canada on the north, and to Oregon and California on the west. . . . . The species appears to have been most abundant to the south, in the Mississippi Valley, it preferring a warmer climate than *Elephas primigenius.*"—(DANA.)

periods. For ages the Ice King held sway over this immense territory. The walrus, and perhaps the musk-ox, the white bear and arctic fox occupied the land that had perhaps shook beneath the tread of the Megatherium and Bootherium, the American lion and the mastodon and elephant; and the creeping willow and procumbent birch and lowly cranberry, the snow white *Arenaria greenlandica*, and other arctic plants succeeded the gaudy flowers and luxuriant forests of the latest Tertiary soil.

Centuries after, the continent slowly sinks, perhaps six hundred feet; the sea laves the foot of the White Mountains; the temperature is raised and the glaciers have retreated to the Alpine valleys. This is the period of the *Leda clays*, in which bones of the bison and walrus are found. But not until a later and still warmer period, that of the rearrangement of these sands and clays into lake shores and fertile river intervals, does the Mammoth (so far as fossil evidence goes) seem to have flourished abundantly.

The remains of the mastodon, found lately in Indiana and stored in the museum of the Chicago Academy of Science, occurred in a peat-swamp four feet beneath the surface, over a bed of marl containing fresh-water shells. This willow swamp had been flowed by the beaver, as its dam and evidences of its lakes were still remaining. Indeed, there are accounts, which however need confirmation, of mastodons' bones being found in the Western States, associated with arrow-heads and other Indian relics, as if the creature had been mired in some "lick," and killed by Indians. We shall eagerly look for fresh discoveries in this direction by our Western naturalists. The mastodon seems to have been more abundant in the Middle States than the Mammoth. The habits and geographical range of the two animals, however, seem to have been very much the same. The true home of the earth-shakers was the Sivalik Hills at the foot of the Himalayah Mountains, seven fossil species of elephants, and three of mastodons having been found there, besides the

living species of elephant. A species of mastodon inhabited the Pampas of Brazil, the bones having been found in the bone-caves near Rio, and the *Mastodon Humboldtii* lived in the Andes. The *Mastodon giganteus* lived on the spruce and fir trees. The food of the tropical existing species is well known to consist of the leaves and succulent branches of trees.

It must seem strange to many of our readers to have had introduced, as a characteristic feature in our landscapes of prehistoric times, herds of wild elephants much exceeding in size the tamed imported specimens that march servilely through our towns and villages. How would the children of to-day grin and wonder with patriotic glee should a squad of veritable *American* elephants stalk through the gaping throng! Such fortune fell only to the lot of the prehistoric urchin. What glorious times were those when the children of the Mound-builders perhaps trooped on gala days of antediluvian rejoicing, to see trained lions and learned horses exhibit in the circus of those days (if the Preadamites were circus-goers); saw the megatherium fed, the hunger of the megalonyx and mylodon appeased with small forests of saplings, and—crowning delight of all—rode on the backs of docile Mammoths and more than elephantine mastodons!*

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*These animals may possibly have been in America contemporaries of the earliest races of men, as some of the species or allied forms are now proved to have been in Europe.

Professor J. Marcou states that human bones have been found either *in* the bone-beds of the Natchez quarternary deposits, or in strata lying *over* them. Regarding the question whether man was really contemporaneous with the Mammoth and the quarternary mammals, Professor Dana states that "in North America there are no known acts sufficiently well authenticated to be here repeated."

Professor Dana, in his Manual of Geology, cites, among the characteristic mammals of this period in North America, the great beaver (*Castoroides Ohioënsis*), the *Bison latifrons* Leidy, a species much larger than the existing buffalo, and a genus of ox (*Bootherium*) related to the musk-ox. A species of stag (*Cervus Americanus* Leidy), larger than the great Irish Elk, and the American Post-tertiary lion (*Felis atrox* Leidy), about as large as the fossil lion of Britain. Other gigantic mammals, such as the *Megalonyx* and *Megatherium* and *Mylodon*, inhabited the Mississippi Valley, as their bones are found associated in the famous Natchez bone-locality with remains of the horse, bear, elephant, and mastodon, now known to have been a resident of North and South America long before Columbus made his voyages.

REVIEWS.

THE POPULAR SCIENCE REVIEW. London (Quarterly).

The October number contains a very valuable and beautifully illustrated article on the Microscope in Geology by David Forbes, of which we make use on another page. — Dr. M. T. Masters attempts to answer the question, Why the Leaves fall? After discussing several reasons given, he thinks "on the whole, then, of all the assigned causes for the fall of the leaf, this last, dependent on an alteration, or rather on a new growth in the leaf itself, is the most important, and probably the only one of itself sufficient to produce the result." This new growth is thus described from Von Mohl's account. "Shortly before the fall of the leaf, there begins to be formed a very delicate layer of cells, the growth of which is from above downwards, so that, beginning from the axillary side of the leaf, and gradually extending downwards and outwards, nearly at right angles to the long diameter of the cells of the leaf stalk, at any rate at right angles to the plane of the leaf, it effects a gradual separation between the stem and the leaf, as effectually as a knife would do." These changes of tissues and consequent fall of the leaf are not wholly due to a change of seasons "from wet to dry, or from hot to cold, for it not unfrequently happens that if a tree be stripped of its leaves in summer, it forms during the autumn new ones, which remain on the tree during the greater part of the winter, or at any rate until long after the usual period."

Dr. E. R. Lankester gives a very useful article, well illustrated, on the Flat-worms or Planarians. The subjoined table* presents the latest views as to the classification of *Worms* taken from Peter's and Carus

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*A TABULAR VIEW OF THE CLASSES AND ORDERS OF VERMES.

Sub-kingdom: Vermes.

Class I. *Annulata* (Ringed-worms).
- Orders: *Polychæta* (Marine).
  - *Oligochæta* (Land and Fresh-water).
  - *Discophora* (Leeches).

Class II. *Gephyrea* (connected through the Sea-cucumbers to Echinodermata).
- Orders: *Sipunculus*, etc.

Class III. *Rotifera* (connected to Arthropods and Turbellaria).
- Orders: *Cephalotricha* (Wheel-animals).
  - *Gasterotricha* (Hairy-backed animals, Chætonotus).

Class IV. *Nematelminthes* (Round-worms).
- Orders: *Nematodes* (Thread-worms, Vinegar-eels, etc.)
  - *Gordiacea* (Hair-worms).
  - *Acanthocephali* (Echinorhynchus).

Class V. *Platyelminthes* (Flat-worms).
- Orders: *Turbellaria* (Planarians and Nemertians).
  - *Trematodes* (Flukes, King's Yellow-worms).
  - *Cestodes* (Tape-worms).

Handbook of Zoölogy (Leipzig, 1863). We might say, however, that the more conservative zoölogist would substitute *class* for sub-kingdom, and *order* for class, considering the worms as a class of the "type," "branch," or "sub-kingdom" ARTICULATA. Such tabular lists of different classes of the animal kingdom we design to give from time to time in the NATURALIST. The *Rotifera*, or Wheel-animalcules, placed by Dana and other authors among the Crustacea, seem to the author to belong more properly with the Worms, connecting the latter with the Crustacea. He also notices the growing opinion among zoölogists, that the majority of the *Infusoria* may be classed among Vermes, near the Turbellaria, or Flat-worms, of which the dark, flat, leach-like worms abounding in our pools and on the seashore are examples. Their wonderful powers of reparation of injuries has been studied by Dugés, who, by slicing them with scissors, produced individuals with double heads and tails, and other modifications of form. The curious modes of reproduction are thus noticed: —

The Turbellarians propagate either by eggs deposited and fertilized in the water, several eggs being often deposited in one mass of yolk (like what was observed by Dr. Carpenter in the Dog-whelk), or by the growth of young from internal buds or pseud-ova, like the larvæ of Cecidomyia, or by transverse fission. Both Nemertians and Planarians exhibit these three methods. The young either develop directly, becoming similar to their parents at once, or they exhibit a jointed ringed structure (like Annelids), sometimes, too, carrying bristles, as has been lately shown by Mr. Alexander Agassiz, both in Planarians and Nemertians, and then, as they grow older, lose their jointed appearance and setæ; or the egg hatching results in a larva (*Pilidium*) which is totally unlike the parent, and from the body-wall of which a small worm-like animal grows and separates, leaving the bulk of the *Pilidium* to perish. This last case is very similar to that observed by Johannes Mueller in certain star-fishes. As in the Echinoderms, so in the Turbellarians, there appears to be no *rule* as to the method of development; nearly allied forms may present the most diverse conditions, the one passing through a larval stage, and the other developing directly in the most capricious manner.

Dr. Richardson writes on the Physics of the Brain, and concludes from experiments in freezing certain parts of the brain in animals, and other like experiments, by which the functions of the different parts or ganglia are determined, "that impressions are physical realities, stamped as it were on brain matter, each distinct and perfect when the matter on which it is set is in condition for motion. Everything we remember is, I doubt not, thus imprinted on the brain, on infinite points of brain-substance, each independent, free, and capable of motion when the whole mass is charged with force. The brain, in fact, is a world within of the world without that it has received in the course of its waking life."

When we see what the micro-photographer can thus do in putting physical impressions on what seem infinitesimal points of matter, and when we know that there is no assignable limit to this art, it is no crude inference that in the vast surface of the gray matter of the brain, in those cerebral lobes of which I have spoken, myriads of points of matter are thus impressed, — points of matter floating in that eighty-four per cent. of water, of which the brain is made up.

One more fact relating to the physics of the brain, as taught by experiment, and I have done. We have seen that when the anterior cerebral ganglia are destroyed for a time, an animal moves impulsively forward, and that, when the cerebellum is destroyed, the animal moves impulsively backwards. This indicates the existence of a balance of power between these centres (or ganglia); a balance which is also detectable between other centres. It is therefore a fair inference, that every centre of power in the brain is, during healthy states,

physically balanced, and that what is called a well-balanced mind is really a properly balanced brain. By this reading we explain many phenomena of living action otherwise inexplicable.

Among the reviews, a kindly word of welcome is given the NATURALIST.—MM. Bert and Blondeau have been experimenting on the contractions of the Sensitive Plant:—

M. Blondeau experimented on plants with the induced galvanic current of a Ruhmkorff's coil. He submitted three plants to the influence of the electric current. The first was operated on for five minutes; the plant when left to itself seemed prostrated, but after a while (a quarter of an hour), the leaves opened, and it seemed to recover itself. The second was acted on for ten minutes. This specimen was prostrate for an hour, after which it slowly recovered. The third specimen was galvanized for twenty-five minutes, but it never recovered, and in twenty-four hours it had the appearance of a plant struck by lightning. A fourth plant was etherized, and then exposed to the current. Strange to say the latter had not any effect, the leaves remained straight and open; thus proving, says M. Blondeau, that the mode of contraction of the leaves of the sensitive plant is in some way allied to the muscular contraction of animals.

NATURAL HISTORY MISCELLANY.

BOTANY.

MONSTROUS FLOWERS OF HABENARIA FIMBRIATA.—Mr. W. W. Denslow, of New York, found last summer a spike of this orchid with all the flowers abnormal, spurless, and fringeless. A few of the flowers, examined by me, exhibit the following peculiarities. All of them are dimerous, even to the ovary. The most reduced has the perianth simply of two sepals, anterior and posterior, and the anther and stigma nearly normal: no vestige of petals. The others have a perianth of four pieces, resembling the normal sepals, no labellum, and generally two anthers, alternating with the inner pieces of the perianth. One of these anthers is occasionally somewhat petaloid, but with one or both the cells well formed, although more separated on the petaloid connective; the pollen and the gland nearly normal. In one flower the two opposed anthers are exactly similar, and nearly normal, but with the slender tip of the cells more curved, so that the glands which are contiguous in pairs, are upturned. The stigma is central and symmetrical. In more than one flower there is an attempt at a second pair of anthers, within and alternate with the others; one of these is occasionally well formed, and the other rudimentary.—A. GRAY.

THE ELDER (SAMBUCUS CANADENSIS) AS A NATIVE PLANT.—The responses to our inquiry are generally in favor of the affirmative. The most explicit testimony received, however, is the following, from our excellent correspondent, Mr. M. S. Bebb. He writes: "I never saw *Sambucus Canadensis* out of a fence corner; but my father who was born in Southern Ohio in 1802, and who remembers distinctly the first White and Red Clover, Blue Grass, and Black Mustard he ever saw,—he lived in the back woods nine miles from any settlement, when Cincinnati and Marietta

were mere hamlets,—declares that the Elder was abundant on the islands of the Dry Fork of the White-water River, in the earliest settlement of the country; that he remembers very distinctly making 'spiles' of its stems when tapping sugar-trees, and that it was a great pest in low bottom-lands, and had to be eradicated with much labor when clearings were made."—A. Gray.

German Ivy, so-called, flowering under peculiar circumstances.—Mr. L. H. Brown, of Dayton, Ohio, informs us that branches of this delicate climber, cut in October, were carried into the house and hung around picture-frames upon the walls of a room in which, until winter set in, there was no fire. In about three weeks they began to put forth blossoms, which have never been seen upon the plants growing in soil, and they have kept on blooming for several weeks, the vine growing freely. The old leaves soon withered, but those of new shoots took their place.—A. Gray.

Lespedeza striata Hook. and Arn. The notice in the November number has called forth several communications from the South, where this plant is attracting much attention. Both Mr. Ravenel and Professor Porter call Dr. Gray's notice to the fact, that they sent specimens to him twenty years ago. The Rev. Dr. Curtis writes that the new comer, if we may call it so, has reached Charlotte, North Carolina, where it is a perfect God-send, taking complete possession of the worn-out fields, and is cropped by cattle with such avidity that a good specimen is hardly to be obtained. Professor Porter writes as follows:—

"I have read with great interest the note of Dr. Gray concerning the introduction of this foreigner into the Southern States, and, as the date when, and the place where it was first observed, may be of importance, wish to put on record the fact, that, twenty-one years ago, in August, 1846, I collected the specimens, now in my herbarium, in Monticello, Jasper County, Central Georgia. It grew in a wild nook by the side of a road, at some distance from the village and any human habitation. I never dreamed of China and Japan, and have hitherto regarded it as a native waiting for a name."—T. C. Porter.

A Relic of the Glacial Epoch.—On the south bank of the River Delaware, in Bucks County, Pennsylvania, fifteen miles below Easton, and forty north of Philadelphia, there is a range of perpendicular, forest-crowned cliffs, extending east and west for a mile and a half, and varying in height from three to four hundred feet. The rock is New-red sandstone, identical with that of the valley of the Connecticut, as shown not only by its lithological characters, but also by the fossil footprints which it contains. On the faces of the cliffs are several extensive water-drips, and at two or three points they are penetrated by narrow and shallow ravines, down which rivulets come leaping. At these places the ice accumulates in immense masses during the winter, and lies undissolved until late in the spring. This was observed whilst passing along the railroad

on the opposite side of the river, and the inference drawn that the mean annual temperature of the rock would be so reduced by the slow melting of the ice, and the large amount of evaporation in summer, as to afford favorable conditions for the growth of northern plants. In hope of finding something of the kind, the spot was visited on the eighteenth of May, 1867, in company with Professors Green and Hitchcock, of Lafayette College, and our search was rewarded by the discovery of *Sedum Rhodiola* D. C.,—an inhabitant of high latitudes in Europe and America, its nearest known station in our country being Quoddy Head, on the eastern border of Maine. The existence of such a plant in such a locality can well be explained only by the supposition, that, when the arctic flora retreated northward at the close of the glacial epoch, it was left behind. Far up on the ledges of the rock, chiefly under the drip of the water, it grows in dense tufts, whose pale, glaucous hue attracts the eye of the botanist, in situations so difficult of access, and in such abundance, that it bids fair to maintain its hold as successfully for ages to come, as it has for ages past.

It may not be amiss to state also that in New Jersey, ten miles to the north of these cliffs, *Polemonium cæruleum* L. has been recently detected in a large, shaded, sphagnous swamp, where it is evidently indigenous; and that, a few miles farther on, in the same range, occur other northern species, among which are *Bidens Beckii* Torr., *Lobelia Kalmii* L., *Betula pumila* L., and *Carex flava* L.—T. C. Porter.

Polyporus frondosus.—A specimen of this enormous fungus was recently exhibited at one of the Horticultural Society Exhibitions at Boston. It was found growing on the decayed stump of an oak tree in Boxford, Mass., by Mr. James Barratt. It belongs to a group of the *Polypori*, which is characterized by an eccentric growth. From a central base arise large imbricate clusters of rounded, lobular extensions which grow from the pseudo-branches of the main stipe. These lobes are light-brown above, and the texture of the upper portion is stringy and scurfy. Underneath they are studded with the numberless pores which give rise to the plant's generic name. The species of the genus are very numerous, all of them markedly characterized by the multiplicity of minute pores which clothe the under surface of the expanded top, called the *pileus*. Many of them have the upright stem, called the *stipe*, exactly in the centre, so that the plant resembles an umbrella, the sticks of which are replaced by a serried mass of vertical tubes, on the inner surface of which grows the reproductive dust called *spores*. The *P. frondosus* produces its *pilei* in side growths, which look like thick, fleshy leaves, and hence the specific name.

Many of these eccentric species grow to an enormous size. The specimen referred to was four feet in circumference. A specimen of *P. giganteus*, collected in Forest Hill Cemetery some years ago, was over five feet in circumference, and weighed ten pounds.—C. J. Sprague.

THE TORREY FESTIVAL. — The Botanical Club of New York has been for some time engaged on a catalogue of the plants growing within thirty miles of New York city. A catalogue, embracing the same territory, was made in 1817, by Dr. John Torrey, and the club celebrated the fiftieth anniversary of its completion by a supper at the Astor House, on the twentieth of December. Invitations were extended to those who had prominently identified themselves with American botany, and the club wishes us to say that they used all possible diligence to invite all interested, and if there were any omitted, it was from inadvertence. The day was unfortunately one of the most inclement of the year, and the impediments to travel prevented many from coming from abroad. Among the guests were Professor Gray and Dr. Pickering, of Cambridge; Professors Eaton and Brewer, of New Haven; Professors Porter and Green, of Easton, Pa.; Thomas P. James, of Philadelphia; S. T. Olney, of Providence; C. F. Austin, Closter, N. J.; S. B. Parsons, of Flushing; and I. Buchanan, of New York. All present were furnished with a button-hole sprig of Torreya, and after a short time spent in social intercourse, the company were seated at table, Professor Thurber presiding. After the substantials had been disposed of, Professor Thurber gave the following

ADDRESS.

For some occult reason I have been placed in a position where I am to speak for the Botanical Club of New York. It is indeed a pleasure to meet such a number of botanists, and my first duty is to express the thanks of the club to those who have come from abroad at this inclement season to aid us in our festivities. The incentive to this genial gathering is so well understood, that any elaborate remarks are fortunately unnecessary. On December 22d, 1817, there was presented to the Lyceum of Natural History, "A Catalogue of Plants growing spontaneously within thirty miles of the city of New York." The Botanical Club, which comprises, so far as we are aware, all the working botanists of New York and its suburbs, has thought proper to mark the fiftieth anniversary of an event so interesting to local botanists, and the commencement of a career so important to botanical science, not only in America, but in the world.

Here I must correct an error of the printed invitations, which are made to say that this is the fiftieth anniversary of the publication of the catalogue. The title-page bears the date of 1819, and an explanatory advertisement says, "Although the following pages were reported as early as December 22d, 1817, unavoidable obstacles have delayed its publication until the present time." It is not the publication of the catalogue that we celebrate, but its completion and presentation to the body which requested it to be prepared. As the 22d day falls this year on the sabbath, the nearest convenient day was chosen. There may be those who think it would have been more appropriate to regard the anniversary of publication, rather than that of its presentation. Such are assured that the club will consider the subject in season for the centennial anniversary. This little volume is now so rare, that I have brought it here, in part be-

cause it may be of interest to some to see it, but mainly because its time-stained pages would prove more eloquent than any words of the speaker. It is the author of this little catalogue in whose honor we are assembled. I am aware that on occasions like the present it is customary for the speaker to assume that the hearers are quite in doubt as to the person spoken of, and to relieve their minds only at the close of his speech, by announcing the name of the one who has been eulogized. Unskilled in the arts of the table orator, and quite sure of being unable to keep this company in a state of suspense, I go directly to the point and say that the author of the catalogue is Doctor JOHN TORREY.

As we look through the pages of the volume, we are astonished at its completeness, and wonder that a mere youth could have accomplished the great amount of preparatory labor necessary to the task.

In imagination we can look back over the intervening half century, and see the young enthusiast herborizing in localities that are to be found only in this catalogue. The "swamp behind the Botanic Garden," and the "bog-meadows near Greenwich" have long ago been built over, and Love-lane is now a paved street. The station here recorded for *Draba Caroliniana* has ceased to be available to the botanist of the present day, as that plant no longer grows, according to the catalogue, "in sandy fields about Canal street." Not only have localities disappeared, but those whose names are associated with them, and who are recorded as having contributed material to the catalogue, have passed away also. Mitchell, Nuttall, Rafinesque, Eddy, LeConte, Cooper, and others, while they live in the memory of a few of those present, are to the most of us known only by their works. From this catalogue as an initial point, let us briefly survey the intervening half century with reference to the botanical works of its author.

In 1820, there appeared in Silliman's Journal, vol. 4, *A Notice of Plants collected by Capt. N. Douglass around the Great Lakes at the Head-waters of the Mississippi.*

In 1823, the Annals of the New York Lyceum of Natural History contained the first instalment of the many precious contributions made by the author to our knowledge of the plants of the far West. Its title is, *Descriptions of some new or rare Plants from the Rocky Mountains, collected by Dr. Edwin James.*

In 1824 was published, *A Flora of the Northern and Middle United States, or a Systematic Arrangement and Description of all the Plants heretofore discovered in the United States north of Virginia.* But one volume of this work was published, and as a portion of the edition was destroyed by fire, it is now only rarely to be met with. It contains over five hundred pages, and includes the first twelve classes of the Linnæan system.

In the same year, 1824, we find in the Annals of the Lyceum, *Descriptions of new Grasses from the Rocky Mountains;* and in the same volume Dr. Torrey appears as editor and joint author with Schweinitz, of *A Monograph of the North American Species of Carex.*

The year 1826 was marked by the publication of the *Compendium of the Flora of the Northern and Middle States*, a work so full, concise, and compact, that it was indeed a compendium. Probably some of those present can remember when this volume came to their relief, and the delight with which they turned to its brief diagnoses, after puzzling over the vague and unsatisfactory descriptions of other works.

On the 11th of December, 1826, our author read before the Lyceum, *Some Account of a Collection of Plants made during a Journey to and from the Rocky Mountains, in the Summer of* 1820, *by Edwin P. James, M. D., Assistant Surgeon U. S. Army*. This paper was not published until 1828. It is a memoir of some eighty pages, and enumerates 481 plants, many of which were new species. This was, up to the date of its publication, the author's most important contribution to science, and is even now frequently referred to by the student of our Western plants. It besides has an especial interest, as it was the first American work of any importance in which the arrangement was according to the Natural System. The only exception to this is a list by Abbé Correa, of those genera appended to Muhlenburgh's Catalogue, arranged according to the Natural Orders of Jussieu. *A Catalogue of North American Genera of Plants, arranged according to the Orders of Lindley's Introduction to Botany*, was published in 1831, both in a separate form, and as an appendix to an American edition of Lindley's work.

In 1836, the Annals of the Lyceum are rich with the *Monograph of the Cyperaceæ*, and the volume for 1837 contained a memoir on *New Genera and Species of Plants*.

The year 1838 saw the commencement of the *Flora of North America, by John Torrey and Asa Gray*, which was published in numbers and at intervals until the year 1843. The rich treasures brought in by our Western explorers interrupted the continuance of this work, and its authors directed their energies to plants from hitherto untrodden fields. That elaborate work, in two large volumes, *The Flora of the State of New York, by John Torrey*, was published in 1843, a year which began a remarkable era in American botany. In that year commenced that magnificent series of contributions to our Western Flora by Torrey, Gray, and others, which followed one another in rapid succession. Nicollet's plants, published in his report in 1843, was the first of this almost continuous series of reports, of which I will mention only those wholly or in part by Dr. Torrey. That daring young lieutenant of the Topographical Engineers, now General Fremont, made two expeditions to the Rocky Mountains, the botanical results of which appeared in 1845. The report of the plants collected by Emory followed in 1848.

In the Smithsonian Contributions we find three memoirs by our author accepted in 1850, though they were not published until a year or two later. These were *A Memoir on Batis*, another on *Darlingtonia*, and *Plantæ Fremontianæ*, which last contains descriptions of some new plants collected by General Fremont in his memorable expedition to California.

The year 1852 gave us the plants collected by *Stansbury in the Region of Salt Lake*. The plants of *Marcy's Red River Expedition* appeared in 1853, and those from *Sitgreaves' Zuni and Colorado Journey in* 1854.

The rich collections made by the botanists attached to the several Pacific Railroad Surveys, were published in 1855 and 1856. The plants of some of these expeditions were elaborated by Newberry, Durand, and others. Those collected by Beckwith and Gunnison, and by Pope on the Llano Estacado, appeared under the joint authorship of Torrey and Gray. The botanical portions of the reports of Parke, Williamson, and Whipple are by Dr. Torrey. The report of Whipple's Expedition is the most extensive of all these Pacific Railroad contributions to botany, as the journey crossed a country not heretofore penetrated by any botanist, and which afforded a rich harvest not only in new species, but new genera. To the other reports, those which do not bear his name as author, of the botanical portion of them he contributed freely, often working up entire families.

The most voluminous, as well as in some respects the most important of these Botanical Reports of the Government expeditions is that of the Mexican Boundary, published in 1859, and with this I close this chronological account, remarking that some contributions to science have been omitted altogether.

This little catalogue of 1817 began the list, and it closes with the elegant quarto of the Mexican Boundary. Indeed there is no student of American Botany who has not almost daily occasion to refer to the works of TORREY.

Is it not fitting, then, that we should celebrate the fiftieth anniversary of the opening of a career that has brought so many benefits to us, and has given such lustre to American science? I have spoken of what would seem to be the work of a lifetime; but when we recollect that all this was done aside from other duties, as recreation from labor as it were, we can only wonder at the zeal and industry it indicates. But those who estimate the services of Dr. Torrey to botany from his published works alone, omit a large and important share. Those present do not need to be reminded of the personal aid he has given them in their studies. What lover of plants, however young or unskilled, ever failed to receive his patient attention and kind word of encouragement? Not only those who have had the advantage of personal acquaintance with him, have been the recipients of this aid, but those who have never met him have felt it through his correspondence. These are works that will never be published, but they are deeply imprinted on the hearts of botanists in all parts of the country.

It may be thought that this hurried review of the botanical labors of our guest is incomplete, without some reference to his character as a man.

It is always a delicate task to speak fittingly of another in his presence; and I could hardly trust myself to give utterance to what I feel is due him. Happily I am saved from the embarrassment that the attempt

would bring, by speaking what is in the thoughts of all here present. Every one who has been brought in frequent communication with him knows that he has forgotten the philosopher in the friend, and that he has been made not only a better botanist, but a better man.

Many years ago, Arnott published in Taylor's Annals of Natural History a description of a new genus, established on one of the beautiful Conifers of Florida, and gave it the name of *Torreya*. The Florida species is *Torreya taxifolia*. Since then there have been added to the genus *Torreya nucifera* from the island of Japan, *Torreya Californica* from the Pacific coast, and possibly another from Northern China, *T. grandis*. While we are glad that a so fine and widely spread genus should bear the name of our friend, we regret that Arnott had not been more happy in his choice of a term to designate our native species. Although a native of Florida, it is hardy on this island, and even as far north as Fishkill, on the Hudson. It holds its bright foliage through the cold and snows of winter, and its presence here suggests thoughts of more genial climes and seasons. Had Arnott possessed the power of prophecy, he surely would have written *Torreya sempervirens;* for does not he whose name it bears disregard the frosts of time? Does not his presence always bring genial summer, and show us that years bring no winter to the heart which has not lost the freshness of youth, but in which love—love to man and to God—reigns supreme? Long after the flowers shall have bloomed above us all, future botanists will carry on the work he has so nobly helped. Those yet unborn will wander by the Southern rivers, visit the mountains of far-off Japan, or climb our own grand Sierra Nevada in search of the Torreya, and his name will be remembered as long as there shall be botany and botanists. But these can only talk of him whom it is our privilege to know, to honor, and to love, and whose presence we now greet with the already too long-delayed sentiment: Long life, health, happiness, and every blessing to our honored guest, Doctor John Torrey.

Doctor Torrey, after feelingly expressing his thanks, and the surprise which this demonstration was to him, gave an interesting account of his first introduction to the study of botany, and the great difficulties that attended the student in those days. Botanical books, which, or their equivalents, are now to be had by every one, were then only to be found in the library of the New York Hospital. Doctor Torrey gave an account of some of the earlier teachers in the science,—Hosack, Eddy, Mitchell, and others, and a sketch of the history of the Elgin Botanic Garden.

The next regular sentiment was, "The Flora of North America; its past history and future prospects." This was responded to by Professor Gray, who facetiously remarked that he hardly knew what Flora was intended; but taking one view of it, if he were to judge from the number of young devotees that he saw, he should consider Flora's prospects very flattering. He spoke of those who were collaborators in the Flora of North

America, and especially of Sartwell and Dewey, both of whom had recently died, and to whose memory he paid a feeling tribute.

Dr. Pickering, who was with the U. S. Exploring Expedition, replied to a sentiment referring to government aid to science. Professor Eaton, to one on botany in our colleges. The Flora of California was the subject of remarks by Professor Brewer, which were interesting as well as humorous. Mr. Wm. Leggett, of the club, gave an account of the new local flora now in preparation. Mr. James Hogg, a member of the club, spoke of the relations of botany to floriculture. Professor Porter, Mr. S. T. Olney, and Professor Trail Green each made brief speeches.

One of the interesting events of the evening was the production by Mr. T. P. James of a manuscript volume found in the Library of the Academy of Natural Sciences of Philadelphia. Although the writer's name is not given in the volume, yet from the places visited and the plants mentioned, there is no doubt that it is the diary kept by Pursh while he was in this country. It is very minute in its account, and is written in such imperfect English, that readings from it created much merriment. It came into the possession of the Academy with the plants belonging to the late Dr. B. S. Barton, who, it is well known, was a friend and patron of Pursh. Professor Gray remarked upon the singular way in which things long separated would sometimes come together. He had, from the sale of Lambert's library in London, a MS. map of the United States, with Pursh's route traced upon it, and as that evidently belonged with the diary, he should take pleasure in presenting it to the Academy.

Letters were received from many botanists who were unable to be present; all of them expressed great regret at their necessary absence, and each one conveyed the warmest good wishes to Doctor Torrey.

The letters were read by Dr. F. J. Bumstead, and among them were those from Professor J. T. Rothrock, Dr. J. W. Robbins, L. Lesquereaux, George Vasey, George W. Clinton, Dr. J. Carson, Professor E. Tuckerman, W. D. Brackenridge, Professor J. Lewis Russell, Dr. Z. Pitcher, Professor J. P. Kirtland, and that of Dr. Jacob Bigelow, now the oldest American botanist, we give entire.

BOSTON, Dec. 12, 1867.

GENTLEMEN, — Your kind and flattering invitation, requesting my presence at a supper to be given in New York in honor of my much respected and long-esteemed friend, Dr. John Torrey, is received with much gratitude. If it were now May or June instead of bleak December, I should be irresistibly tempted to join in your appropriate festivity. But as there is at present no travelling conservatory between Boston and New York which can be relied on effectually to exclude the frost, I am obliged reluctantly to give up the proffered pleasure. My acquaintance with your honored guest, Dr. Torrey, dates back for half a century. At that distance of time, I had devoted myself considerably to Botanical studies, and had published a little work on the plants of Boston. Dr. Torrey, who was then meditating a national work on North American plants, with more kindness than discretion, wrote me a letter, generously offering me the use of his collections, notes, and personal assistance, if I would undertake the enterprise. Fortunately for Botanical Science, I declined the responsibility, and the work has since been wholly carried out by himself and his distinguished colleague, Professor Asa Gray. For myself, I have been obliged to confine my herborizations mostly to the pavements of the streets, though at times I have broken loose in pursuit of my first love, and have gathered plants on the Rhine, the Rhone, the Tiber, and the Danube, not overlooking the St. Lawrence and the Mis-

souri. In June of last summer I found myself culling simples at Fort Harker, away among the buffaloes and prairie dogs on the Smoky-hill fork of the Kansas River.

Although if a scientific section of my trunk were now to be made, it might exhibit about four-score annual circles, yet I am happy to state that the ligneous fibres appear thus far to do their duty, and the sap vessels to transmit their contents. And I confidently trust that on no occasion will my botanical friends find me to be hollow-hearted.

I am, gentlemen, with the greatest respect, your obedient servant,

JACOB BIGELOW.

ZOÖLOGY.

THE BREEDING HABITS OF BIRDS.—I notice in the November number of the NATURALIST an article from Mr. Fowler, in which are given some interesting facts in relation to the breeding habits of several of our birds, but which are, as Mr. Fowler says, so utterly at variance with the accounts given of these bird's habits in my recent book, that I unwillingly trespass on your limits for an explanation, and reiteration of some of my remarks. In the work referred to, I describe the Kingfisher's nests as being placed in holes excavated in sand-banks, to the depth of three, four, sometimes six or eight feet.

The holes found by Mr. Fowler were less than three feet in length, and none of them contained any nest materials whatever. Here Mr. Fowler's experience is entirely different from my own, for of numbers of these holes that I have dug out, many of them were beyond four feet in length, one certainly more than six feet, and I have heard of one that was carried to the depth of nearly eight feet. All of these holes had their loose nests composed of straws, sticks, and a few feathers, and I should be surprised to meet with the eggs laid on the cold damp earth, such as would be at the bottom of such deep excavations. I find, on referring to the various authors, that nearly all had similar experiences with mine.

Audubon says, "The hole is dug to the depth of four, five, or sometimes six feet; at the farther end, on a few sticks and feathers, the eggs are deposited."

Wilson says, "The hole is dug, sometimes to the extent of four or five feet. The nest is constructed of loose grass and a few feathers."

Nuttall says, "The bank is horizontally perforated, to the depth of five or six feet. Here, on a few twigs, grass, and feathers, the eggs are deposited."

Dr. Thompson, in "Birds of Vermont," says, "The perforations sometimes extend five or six feet into the bank. The nest consists of twigs, grass, and feathers."

In describing the breeding place of the Red or Mottled Owl, in my work, I use the following language: "The Mottled Owl selects for a nesting-place a hollow tree, often in the orchard. The nest is made at the bottom of the hollow, and is constructed of grass, leaves, moss, and sometimes a few feathers. It is not elaborately made, being nothing more than a heap of soft materials."

Here again Mr. Fowler disagrees with me, saying that the bird makes no nest, or, at least, he has never found one. I can only say that I have found numbers of the nests of these birds, none of which were in the "abandoned nest of the crow or hawk," but all were made, as before described, in holes in trees. I have had over fifty eggs of this species sent me during the past season, and all were found in such nests as I have described. With this species I also find that my accounts are supported by other authors.

Nuttall says, "The nest is usually in the hollow of an old orchard tree; it is lined carelessly with a little hay, leaves, and feathers."

Audubon says, "The nest is placed in the bottom of the hollow trunk of a tree, often not at a greater height than six or seven feet from the ground, at other times so high as from thirty to forty feet. It is composed of a few grasses and feathers."

Dr. Thompson, in "Birds of Vermont," says, "Their nest, which is made of grass and feathers, is placed at the bottom of a hollow tree or stub."

I give this matter this extended notice, not for the purpose of throwing discredit on Mr. Fowler's statements, for I know him to be a good observer, but to show that my descriptions will faithfully apply to, at least, the majority of occurrences in the breeding habits of the species referred to.

As to the matter of the Marsh Hawk's nest being "rather neatly woven," to which Mr. Fowler takes exceptions, I will say that perhaps "interlaced" would be a better word, since "woven" gives an idea of sewing, such as the process of preparing the nest of the Vireo and Oriole, but "interlaced" conveys the idea of careful adjustment, which should be understood in connection with the nest of this species.—EDWARD A. SAMUELS, *Boston.*

BEE PARASITE.—Inclosed you will find some thin shavings from boards and slabs where the *Xylocopa* abounds, with small eggs attached, which I strongly suspect to be those of *Anthrax sinuosa*. They are found quite numerously around the openings of the cells of the former insect, and also extend to some distance from them. In pressing some of these eggs with the point of a pin, small maggots made their appearance, but my lens was not powerful enough to enable me to make out what they were, but they seemed to me to resemble very much the Anthrax in its earliest stages, as I have found it on the Xylocopa. I have no doubt you can determine this matter,* and should it prove to be what I have supposed it is, it will open an interesting field for future observation. One reason that strongly inclines me to the belief that they are the eggs of Anthrax is, that one day I discovered an *Anthrax* on the wing by one of the openings of a Xylocopa cell, acting in the same manner as the Bot-fly in depositing its eggs on the horse. I was very busy at the time, and

*The eggs had dried up so they were not recognizable.—EDS.

did not look for the eggs until some time afterwards, when I found those of which the inclosed are a sample. However, I think if you find them to belong to a dipterous insect, there can be no doubt but they are those of *A. sinuosa.*—JAMES ANGUS.

HIBERNATION OF WILD BEES.—I beg leave to say that I think you have made a mistake in supposing or stating that the females only, and not the males of *Ceratina dupla*, survive the winter. Both sexes, according to my observations, hybernate, as also *Xylocopa Virginica*.

I beg leave also to make another correction. You say,* with regard to Ants, that the workers only hybernate. I have found the females of some species hybernating in common with the workers in great quantities, and not unfrequently males also. While this is the case with some species, I think what you say is correct with regard to others.—JAMES ANGUS.

JUVENILE NATURAL HISTORY SOCIETY.—We have in this city perhaps quite a scientific curiosity, namely, a *Juvenile* Society of Natural History, composed of boys less than twenty years of age. We have been organized two years, and are now in a very flourishing condition, although it was hard "tugging" for a few of us the first year. We have, for us, a large collection, and a good one, numbering some eight hundred specimens. We cannot, of course, do much at research, but we are coming surely along the road you older naturalists have gone; and, by and by, when we get on the frontier where you are, you will hear from us.—G. W. SMITH, *Grand Rapids, Michigan.*

PROTECTION OF TREES FROM INSECTS.—The quantity of fruit destroyed by insects that deposit their eggs in the blossoms is enormous. These creatures are said to have a great antipathy to vinegar, the mere odor of which is enough to drive them away, and, in some cases, to destroy them, and nothing more is required than to sprinkle the branches with a mixture of vinegar and water at the moment the blossoms begin to appear. The solution, consisting of one part of strong vinegar to nine parts of water, can be sprinkled over the flower-buds by means of a garden engine or syringe, or even with a watering-pot with a fine nose. —*Proceedings of the Entomological Society, London*, 1866.

OCCURRENCE OF THE BARNACLE GOOSE IN NORTH AMERICA.—A specimen of this goose (*Bernicla leucopsis*) has recently been received by the Smithsonian Institution from Mr. B. R. Ross, a gentleman well known for his collections and publications relative to arctic zoölogy. It was obtained by that gentleman near Rupert House, on James Bay (the southern end of Hudson Bay), and is believed to be the first North American specimen brought to the notice of naturalists. It has for a long time been indicated as belonging to our fauna, but only on hearsay evidence of gunners and travellers, and it is not mentioned by Richardson at all in his work on American Arctic Zoölogy.—S. F. BAIRD.

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* Naturalist, Vol. I, p. 392.

A Double Egg.—Yesterday one of my servants, on opening a hen's egg found another egg within it. The inclosed was about the size of a robin's egg, with a well-formed, slightly rough shell. It lay in the white. The parent egg was fully formed and was eaten. I heard of it on arriving home, and secured the small one. It has not yet been opened.—E. L. S.

There are two similar specimens in the Museum of the Essex Institute. Two cases are also mentioned as occurring in England, in *Hardwicke's Science Gossip*, in which it states that a "communication was made last year to the Académie des Sciences of France, of a similar occurrence."—Editors.

Habits of the Striped Snake.—A case of the common striped snake killing its prey—a common mouse—after a chase by crushing it in its folds in the boa constrictor manner, has for the first time come to my knowledge. In trying to escape, the mouse ran up the inner angle of a wall some eighteen inches, when the snake (which was about twenty-four inches in length) caught it, enveloping it in its folds with lightning-like rapidity, crushed and killed it, and then swallowed it, all after the manner described of the large constrictors, except perhaps the chasing.—F. W., *Newark, N. J.*

MICROSCOPY.

The Microscope in Geology.—D. Forbes, in the Popular Science Review, writes on this rather novel subject. After a few prefatory remarks upon the general advantages of the use of the Microscope in studying the intimate structure of rocks, the author divides them all into two classes, "Primary or Eruptive," and "Secondary or Sedimentary Rocks." Under the first head he states that "the mineral constituents of such rocks are seen to be developed as more or less perfect crystals, at all angles to one another," which he infers could only take place in a rock at one time, "in a state of liquidity or solution" (aqueous or igneous). When "quartz, leucite, calcite, felspar," and other colorless minerals present similar appearances in thin sections, they may be distinguished by "their optical properties and the use of polarized light;" by similar tests different forms of the same mineral may be separated, and the structure, whether crystalline or vitreous, determined, and the alterations in eruptive rocks produced by the action of water, the atmosphere, or other agencies advantageously studied. In conclusion, reference is made to the discovery by Sorby of the existence "of numerous minute fluid cavities in the quartz of granites," and also in volcanic rocks, "in the felspar and nephiline ejected from the crater of Vesuvius." These facts, and the farther statement that "fluid vapor, gas, and stone cavities, are common both to the volcanic quartz-trachytes and the oldest granites," are used as proving the great value of the microscope in this branch of inquiry. Under the head of Sedimentary Rocks, the author distinguishes

three kinds or classes: 1st. "Those composed of the immediate products of the breaking up of eruptive rocks." 2d. "Rocks built up of the more or less rounded or angular debris of previously existing sedimentary or eruptive rocks." 3d. "Rocks composed of mineral substance extracted from aqueous solution by crystallization, precipitation, or the action of organic life." Strata of the first class are often identical in aspect and chemical composition, but their irregular sedimentary structure is dissolved upon submitting them to the microscopical test. Very fine, compact rocks may be distinguished from crystalline rocks by the same means. "Roofing-slate, however, has a definite arrangement of the particles in lines, which constitute the lines of weakness or the cleavage of the slate." This arrangement, however, is explained by the effects of pressure, applied at right-angles to the structure itself, causing an elongation of some, together with a sliding movement of others of the particles.

Under the third head we notice that the clays of Staffordshire, when altered by contact with basaltic dykes, present a structure identical with common stoneware made from the same clays, and show "no change in mineral or chemical composition, beyond the expulsion of the water always contained in such beds." The foliated schists, quartzites, etc., show the contours of the original sand-grains, and, as Sorby has pointed out, the existence of ripple-drift and wave-structure.

ANSWERS TO CORRESPONDENTS.

THE MISTLETOE.—I believe it is the common opinion of naturalists that the common Mistletoe of this Southern country steals the *elaborated sap* from the stalk which supports it. I think it can be proved that it *does not*, but that it draws its portion of *crude* sap and elaborates it, returning a portion to the tree on which it grows. I would be very glad to know if I am correct in reference to the *common opinion of naturalists*, and will oblige you to inform me.—J. M.

It is not the common opinion that the Mistletoe of the Southern States, or, in fact, any parasite with green foliage, draws *merely* elaborated sap from its host; otherwise why the green leaves? We know that the office of green leaves is to elaborate sap, and therefore in those plants (*Orobanchaceæ*, *Monotropa*, etc.) which depend wholly upon their hosts for elaborated nourishment, we find no green leaves. We should be glad of the record of any observations, which have been carefully made, with the view of proving experimentally that the Mistletoe does not take elaborated sap alone (for it very probably takes *some*) from its host, as they could not fail to be interesting.—H. M.

THE MASTODON IN KANSAS.—I send you a photograph and description of a vertebra of some species of the *Mammalia* for determination. The whole skeleton is said to be imbedded in the mud in one of our

streams, where there is some danger of *savants* losing their scalps. One rib has been detached and ground up into powder by the Indians for medicine.—JOHN D. PARKER, *Topeka, Kansas.*

We referred your letter and photograph to Professor J. Wyman, who writes:—

"The photograph is unluckily taken from an *oblique* point of view, which I believe people will never learn to be a bad one. If the view had been *full* front, or full side, or full anything, it would have been better than this. I have come to the conclusion that it is either the last lumbar, or first sacral vertebra of a Mastodon. The great compression of the spinal canal is in favor of its being sacral."

ARE BEES INJURIOUS TO FRUIT.—In answer to the question by J. J. Gould (Wenham, Mass.), whether bees are in any way injurious to fruit, or lessen its quality or quantity, I would reply that all the evidence given by botanists and zoölogists who have specially studied this subject shows that bees improve the quality and tend to increase the quantity of fruit. They aid in the fertilization of flowers, thus preventing the occurrence of sterile flowers, and by more thoroughly fertilizing flowers already perfect, render the production of sound and well-developed fruit more sure. Many botanists think if it were not for bees and other insects, *many plants would not fruit at all.* This whole subject of the great office bees and other insects perform in the fertilization of plants has been fully discussed in the May, July, and October numbers of the AMERICAN NATURALIST, and by Professor Asa Gray in the AMERICAN AGRICULTURIST, beginning in May, 1866.

It is alleged that bees do injury in some way by extracting the honey from flowers. What is the use in nature of honey? The best observers will tell you it is secreted by the plant for the very purpose of attracting bees to the flower, otherwise it is of no use to the flower or fruit.

If all the bees were to be destroyed, I for one, if a farmer, would prefer to go into some other business. This prejudice against bees seems to us to have no foundation. Known facts prove the contrary. Farmers know too well the injury noxious insects do; it is more difficult to estimate the good done by hosts of beneficial insects. I believe that every intelligent bee-keeper and naturalist will assent to the truth of the above remarks.—A. S. P.

R. H., Nichols, N. Y.—The hymenopterous insect from the sugar-maple tree is the *Tremex columba*. It bores, while in the larva state, into the trunk of the maple and oak. The beetles are *Copris anaglypticus* Say, *Cicindela sexguttata*, *Ancylocheira 6-plagiata* and *A. fasciata*. The fly is allied to *Tabanus*, the House-fly, and has a powerful bite.

E. B., Wheeling, West Virginia.—The microscopic form found in Peruvian Guano appears to be one of the Polycystinæ. The only authority that we know of is Ehrenberg's Microgeologie. Specific, and even generic names, are almost useless in this group of Rhizopods.—C. S.

W. W. G., Ann Arbor, Wis.—The little insects called snow-fleas are probably the *Podura nivicola* of Dr. Fitch. They are found in winter at the foot of trees, under the bark of which they live, and also about manure heaps and in cellars.

The *Heleochara communis*, a homopterous insect, allied in form to the Cicada, or seventeen-year locust, produces the frog-spittle seen in midsummer on grass. The larva sucks in the sap, which passes through the body and forms a frothy mass concealing the insect.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Essex Institute, *Salem.—First Field Meeting at Haverhill*, on Tuesday, July 2, 1867, postponed from the preceding Thursday, on account of the weather. Haverhill, located on the north bank of the Merrimac, is a thriving and busy place, noted for its extensive manufacture of shoes. It abounds in interesting historic lore; for a period of seventy years was one of the most exposed of the frontier towns, and many harrowing tales of Indian barbarity is among its well-authenticated legends. The principal point of attraction to the naturalist is "Kenoza Lake," formerly known as the "Great Pond," a lovely sheet of water, embosomed among the hills, covering an area of about three hundred acres. During their rambles in its vicinity the party was rewarded in finding many interesting specimens in the various departments.

The afternoon session was held in the North Congregational Church, and was called to order at 2.30 o'clock, *Vice-president Fowler* in the chair. *Dr. George B. Loring*, of Salem, made a few eloquent remarks on the prospects of the year, and the occasion which had brought them together. *F. W. Putnam*, of Salem, gave a description of the habits of the common Plant-louse. *Dr. James R. Nichols*, of Haverhill, remarked that chemical science had recently discovered an effectual destroyer of plant insects, a new substance called Carbolic acid, which is eliminated from coal tar, and made farther comments on this subject. Dr. N. also spoke of the collections and library of the Institute, and alluded in very appropriate terms to the recent donation of Mr. George Peabody, for the promotion of science and useful knowledge in this county. *Edward S. Morse*, of Salem, drew a comparison of the studies of the naturalist near the sea with those made in the interior, and alluded to the families of animals found in these respective localities which are worthy of study. *Alpheus Hyatt*, of Salem, spoke of the geological features of this section of the county. *Rev. Dr. Seeley*, of Haverhill; *Hon. Allen W. Dodge*, of Hamilton; *Professor A. Crosby*, of Salem; *Dr. J. Spofford*, of Groveland; *Hon. Warren Ordway*, of Bradford, and others, made interesting remarks.

Second Meeting at Andover. — After a cordial reception by *Professor Thayer*, of the Theological Seminary, the company divided into small parties, and visited the various objects of interest; many went to the library and museum of the Theological Seminary, the new building of the Phillips Academy, etc. The naturalists repaired to the woods and meadows, and were amply repaid for their excursions. The meeting was held in the South Congregational Church. *Dr. George B. Loring*, of Salem, of the Field Meeting Committee, presided, and, on taking the chair, alluded to several interesting episodes in the history of this town, and briefly stated the objects of the Institute. *A. Hyatt*, of Salem, spoke of water as equalling fire in its destructive power,— its agency in producing the various changes on the earth's surface during the several geological epochs. *E. S. Morse*, of Salem, gave a description of several snails, which he had found during the previous ramble, and illustrated his subject by drawings on the blackboard. *Professor Hitchcock* exhibited a map of Andover, upon which he had designated, by different colors, the localities of the four principal kinds of rocks — granite, stratified gneiss, mica schist, and rocks resembling Quincy sienite. *George D. Phippen*, of Salem, spoke of the flora. *Rev. Mr. Smith*, pastor of the church; *Rev. C. R. Palmer*, of Salem; *Mr. F. G. Sanborn*, of Andover; *Professor D. Crosby*, of Dartmouth College; *Professor A. Crosby*, of Salem; *President Larrabee*, formerly of Middlebury College, and others, addressed the meeting.

Third Meeting at Beverly Farms, on Thursday, August 1, 1867. — Disembarking at Pride's Crossing on the Gloucester Branch Railroad, the party separated into groups, under guides familiar with the adjacent country. One of these groups rambled over the wild and elevated region known as "Beverly Commons," and noticed several large and peculiar boulders, also a large variety of interesting plants; another group visited the sea-shore, and strolled through the grounds surrounding the elegant mansions in that beautiful locality. A party of naturalists passed the forenoon in dredging the harbor for crabs, worms, mollusks, and zoöphytes.

The afternoon session was held in the Second Baptist Church, at 2 o'clock, *Vice-president A. C. Goodell, jr.*, in the chair. After a few preliminary remarks from the chair, reading records, correspondence, and donations, *C. M. Tracy*, of Lynn, described the flora peculiar to this region. There were, he observed, marked peculiarities in the flora of Essex county and a part of Middlesex, which seemed to indicate the influence of the geological formation; examples were cited to sustain this supposition. *George D. Phippen*, of Salem, also spoke on the general subject of botany. He observed that all plants were in some sense wild plants, since those cultivated in one country, grow spontaneously in others. *Messrs. E. S. Morse* and *A. Hyatt* spoke of the various objects found during the previous dredgings, — the first named discussed the mollusca, the other the radiates, and also described the different belts or zones in which animals and plants are found, each having its peculiar species.

Joseph E. Ober, of Beverly Farms, gave a valuable historical sketch of West's Beach. He said that the name was derived, not from the point of compass, but from John West, who held a grant of the place from Salem in 1660. *Rev. A. P. Peabody, D. D.*, of Harvard University; *R. S. Rantoul, F. W. Putnam, E. N. Walton, T. Ropes*, and *H. Wheatland*, all of Salem, made remarks appertaining to the objects of the meeting.

Fourth Meeting at Kittery, Maine, on Thursday, August 21, 1867.—The first meeting outside the limits of the State, and the second held out of Essex county. The principal objects of attraction, aside from the natural history of the place, are the U. S. Navy-yard, and the historical associations; here are to be seen the mansion of Sir William Pepperell, the richest merchant and most extensive land-owner in New England at the time when he won his military reputation at Louisburg, and a baronetcy from the English crown; a portion of this building has been changed, but enough remains to give an idea of its pristine grandeur; also, the Sparhawk mansion, built by Sir William for his married daughter, is elaborately decorated; the Cutts' house, etc., etc.

The afternoon session was held in the stockholder's building of the P. S. & P. Railroad, kindly granted to our use by the President and Directors of the road, and was called to order at 2 o'clock, by Vice-president *Goodell*. Various botanical and zoölogical specimens, culled by the members, were laid upon the table, and the chairman called upon various gentlemen to explain them. *Mr. C. M. Tracy*, of Lynn, discussed the floral, and *Messrs. F. W. Putnam* and *E. S. Morse*, of Salem, the zoölogical. *Dr. Elliott Coues*, of U. S. Army, took for his theme the genus *homo*, or that part of it which is native to Arizona Territory, the Apache Indians, and presented some extended remarks illustrative of their habits and character. *Rev. E. C. Bolles*, of Portland, spoke for the Portland Society of Natural History, and then gave an interesting discourse on microscopic fungi. *Rev. Joseph Banvard*, of Patterson, N. J., responded for a new society, founded on the plan of the Institute. *Rev. George D. Wildes*, of Salem, alluded to the Historical Associations of this place. *James N. Buffum*, of Lynn, and others, addressed the meeting. *Capt. Stephen Decatur*, U. S. N., who is now totally blind, and resides at Kittery, was present at the meeting, and seemed to enter fully into its spirit.

Fifth Meeting at Ipswich, Friday, October 4, 1867.—A charming old town, replete with many old historical associations. On arriving, the party proceeded to the Town Hall, where the baskets were deposited, from which they diverged in various directions, some into the woods, along the banks of the river, and down to the very interesting beach just below its mouth. Some took the Topsfield road, in search of plants and snails; others to "the neck," where some ancient Indian mounds were inspected.

The afternoon session was held in the vestry of the Methodist Church. *Vice-president Goodell*, upon taking the chair, explained the objects of the Society, and briefly recounted its history. *George D. Phippen*, of Salem,

spoke of the flora. *E. S. Morse* described the Indian relics found in the mounds on the neck, also those which he had found at Goose Island, in Portland harbor. He concluded his remarks by describing the manner in which certain of the lower animals eat, illustrating the process with figures on the blackboard.

CHICAGO ACADEMY OF SCIENCES. *Oct.* 8, 1867. — Dr. J. J. Jewell, of the Lake Tunnel, read a report in relation to the geology of the Chicago Lake Tunnel.

Dr. Meyers, of Fort Wayne, Ind., then described the finding of the bones of the Mastodon, presented by him to the academy. He said the locality of the bones was accidentally discovered by a farmer named Trush, who was then digging a drain through one of his fields in Noble county, Indiana. He learned of the discovery and purchased the bones found by the farmer, as well as the right to make farther explorations. In carrying on the investigations he called in the aid of Dr. Stimpson, of Chicago. These two spent several days in superintending excavations, and were rewarded by the accumulation of one of the finest collections of mastodon bones ever found. These evidently belong to three individuals, two adult (probably male and female) and one young one. The skeleton of the calf and one of the adults are nearly complete, and capable of being mounted. They lay at the depth of four or five feet, in a stratum of peat overlaying blue clay, containing lacustrine shells. In the peat among the bones were found fragments of boughs and branches of several kinds of wood, in a good state of preservation, some of which had been gnawed by the beaver. The spot at which the bones were found is a small basin-shaped depression in the middle of a corn-field, which was formerly a willow swamp, and has but recently been sufficiently well drained to allow of cultivation. It is a region where traces of ancient lakes and beaver-dams are particularly abundant.

The size of the adult mastodon has not yet been estimated. That described by Dr. Warren measured seventeen feet in length by eleven feet in height, and it is supposed that the largest of these here described will not fall far short of this in dimensions.

BOOKS RECEIVED.

Naturalist's Note Book. London. November, December, 1867.

Land and Water. London. November 2, 9, 16, 23, 30, December 7, 14, 21, 28, 1867. January 4, 11, 1868.

Hardwicke's Science Gossip. November, December, 1867. January, 1868.

Cosmos. November 23,* December 7, 14, 21, 28, 1867. January 4, 11, 18, 1868. Paris.

From Arizona to the Pacific. By Elliott Coues, M. D. (From the Ibis, July, 1867.) 8vo, pp. 16.

The Field. November 30, December † 14, 21, 1867. January 25, 1868. London.

Quarterly Journal of Science. London. January, 1868.

American Bee Journal. January, February, 1868.

Popular Science Review (Quarterly). London. January, 1868.

Chemical News. January, February, 1868.

*** The number for Nov. 30 was never received at this office; will the publishers please mail another copy?**

† The number for Dec. 7 was never received.

THE

AMERICAN NATURALIST.

Vol. II.—APRIL, 1868.—No. 2.

NOTES ON MEXICAN ANTS.

BY EDWARD NORTON.

The insects mentioned in the following paper were forwarded to the Smithsonian Institution from Mexico by Professor Sumichrast, with notes by him upon the habits of several of the species. It is a matter of some interest to notice, that, among over twenty species, about half of which are undescribed, not one is known in the United States, while several are found in Panama and Brazil. Yet many of them live in the temperate region of Mexico!

I have added to the statements of Professor Sumichrast some recorded accounts of several of the species already described, to show how little is really known about these curious insects, and partly in the hope that some reader of this paper may also become an observer of the species around his own home, in their varied habits and occupations and labors. In the whole insect world, only the honey-bee equals the ant in its instinct and the development of reasoning powers which appear truly marvellous in such minute creatures.

Perhaps the most striking peculiarity of the ants is their social character; assembling in companies of almost countless numbers, and yet working in harmony for definite objects;

Entered according to Act of Congress, in the year 1868, by the Peabody Academy of Science, in the Clerk's Office of the District Court of the District of Massachusetts.

for while they have no recognized head or guide, they all seem to devote themselves to systematic efforts for forwarding the public good. All their energies are given to this, and for this they are ready to sacrifice their lives.

The family of ants, in addition to the males and females, which are winged and generally short-lived, presents "neuters," or workers, which are wingless and live throughout the year, and perform the labor of the community. The males and females appear in the summer only. After a certain time, when they are allowed to leave the nest, the whole society teems with excitement, and only settles back into its usual course when the superfluous members fly off in swarms to seek new homes. Of those which remain, the males soon die, while the females tear off their wings, or have them torn off by the workers. Once established, the female soon lays her eggs, which are minute, but increase in size before the larvæ burst forth. These are footless grubs, which are carefully tended and fed by the workers, with a fluid previously elaborated in their stomachs. When fully grown, these larvæ assume the dormant or pupa state, some genera forming cocoons, and some not, and soon undergo the transformation into the perfect insect. These larvæ and pupæ are watched with jealous care by the workers, and are transported by them to different parts of the nest, or more or less exposed to the air according to the temperature. Before man can foresee the coming storm, the nests are securely closed, and ere the skies are fairly cleared, their labors are resumed. The bodies of other animals, the juices of plants, and even the sap secretions of other insects, such as Aphides, or Plant-lice, are taken by them for the nourishment of their helpless charges.

The workers often present two distinct forms, now called the major and minor workers, in addition to which a third set of workers is often found in one nest, which are evidently of another species, but have been captured when larvæ by the stronger species, and bred and enslaved for this purpose.

On this point but little is recorded as yet in this country,* but we have abundant testimony from observers of European species.

The major workers are usually of large size, and have the head greatly developed, but are comparatively few in number. Their duties in the society are not clearly understood, but they are supposed to have some kind of superintendence over the rest.

In the following descriptions I have thought best only to mention one or more of the prominent external characteristics by which the genera of the species here mentioned may be known.†

SUBFAMILY FORMICIDÆ.

In the genus *Formica*, the node, or knot-like segment between the thorax and abdomen, forms a smooth, oval or globular mass, and there is no sting.

Formica esuriens Smith. "This is very common in Orizaba and Cordova. It lives in great numbers in dead trees, in which it tunnels galleries, or under stones." From its form this should be grouped with our large black Formica Pennsylvanica, which lives in dead trees. It is not by any means certain that the species living in dead wood perforates that which is living. It seems much more likely that it occupies the channels already opened by the grubs of various borers, and helps to complete the work partly done for it. In this region the worker remains in a torpid state

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*See Mr. J. A. Allen's "Notice of a Foray of a Colony of *Formica sanguinea* Latreille, upon a Colony of the black species of Formica, for the purpose of making Slaves of the latter." Proceedings of the Essex Institute, Vol. V, p. 14, 1866.

†The Ant-family, ***Formicidæ***, has been separated into three subdivisions, having the following prominent external characteristics:—

Formicidæ.—The first segment of the abdomen forming a single node. (See Fig. 3 *a*, showing the spinose node of Polyrhachis.) Not provided with a sting.

Poneridæ.—The first segment of the abdomen with one node. Provided with a sting.

Myrmicidæ.—The first segment of the abdomen with two nodes. Provided with a sting. From this last, two more subfamilies have been separated,—the *Attidæ*, the major workers of which have enormously developed heads, and the *Cryptoceridæ*, the heads of which are flattened, so that the expanded sides wholly or partly conceal the eyes. They are stingless.

in decaying wood in midwinter. Dr. Fitch has described a smaller species (*Formica Caryæ*) which inhabits hickory trees, boring its passages, as he thinks, in the living wood. The wood on the sides of these passages is much discolored and softened, probably by an acrid fluid (formic acid) emitted for that purpose by the insects.

Formica fulvacea. (Fig. 1, worker major.) "Taken in Cordova, where, in the woods, it ordinarily makes its nests in the middle branches of Bromeliaceous parasites."

Formica nitida. "Inhabits the mountains of Orizaba, where it lives in little companies under the bark of pines."

Formica nacerda. "Orizaba and Cordova. Found upon leaves of plants."

Tapinoma. In this genus the node is usually received into a depression at the base of the abdomen proper, so that at first sight it often seems to be entirely wanting.

Tapinoma piceata. "Potrero (near Cordova.) In the wood of oaks."

Tapinoma tomentosa. (Fig. 2, worker; the antennæ imperfect.) "Orizaba. In little societies under stones."

Polyrhachis. This genus has the node of the peduncle thickened and usually spinose (whence the generic name from the Greek, meaning *many-pointed*), having two, three, or four spines. The thorax is usually more or less armed with spines or hooks.

Polyrhachis arboricola. (Fig. 3, worker, 3 *a*, side view of thorax and abdomen.) "Mexico. Indigenous in the hot region, where it is very common. Its nest is ordinarily placed in the cracks or apertures of large trees. It often chooses the abandoned nests (*Comejens*) of the White Ants, or Termites. (In these Comejens, which are often very large, sometimes dwells a little species of Paroquet, the *Conurus Aztec* Somm.) It is quite vagabond in its habits, and one sees it running around on the trunks of all sorts of trees and leaves of shrubs, which strongly proves it to be essentially a tree inhabitant. It causes no trouble on plantations."

Subfamily Poneridæ.

Ponera. This genus, which is allied to the "Driver Ant" of the west coast of Africa, is known by having the node of the peduncle thickened, nodiform, with the first segment of the abdomen more or less constricted. In the anterior wings there are one marginal, two complete submerged, and one discoidal cell. All the tibial spurs of the tibiæ are pectinate, or comb-like.

Ponera strigata. "Temperate region of Mexico, under stones."

Ponera pedunculata Smith. One worker was received from Mexico. This species has previously occurred at Panama and at Rio.

Ectatomma. This genus is known by the thickened node of the peduncle, and the deep constriction between the first and second segments of the abdomen. The antennæ are inserted low down at the base of the clypeus; the eyes are placed above the middle of the face, while the spurs of only the anterior tibiæ are pectinate.

Ectatomma ferruginea. (Fig. 4, 4 *a*, side view of peduncle of the abdomen.) "Mexico. This species is only found in the *encinales*, or oak forests of the hot and temperate region, where it lives in little societies under the trunks of fallen trees." The male differs very greatly in its antennæ and the form of the thorax from the worker. Mr. Smith has noted and figured several such cases. But this species seems peculiar in the division of the metathorax.

Subfamily Myrmicidæ.

In the genus *Eciton*, the peduncle consists of two nodes. The males and females are unknown. Both kinds of workers have very minute eyes, which are absent in some species. In several species the major workers have very long mandibles curved at the end, but without teeth.

Eciton hamata Fabr. "Rio Atoyai, near Cordova." This is also found in Brazil and Cayenne. The two kinds of

workers in this and the succeeding species have been previously described.

Eciton Mexicana Roger. (Fig. 5, worker major, 5*a*, front view of head showing the immense sickle-like mandibles, and only the two basal joints of the antennæ. Fig. 6, worker minor, with a front view of the head, showing the mandibles of the usual size.) "Cordova, Orizaba, etc."

Eciton brunnea. "Occurs at Cordova, Orizaba, etc."

Eciton Sumichrasti. (Fig. 7.) "Cordova, Orizaba, etc. All the researches that I have made up to this time to discover the *formicarium* of the Eciton, have been fruitless, and I cannot obtain any information from the natives where these insects are common. At one time only (May, 1865) I found under a fallen trunk a prodigious number of workers of *E. Mexicana.* They were heaped and piled upon each other like the bees in a swarm. Attacking them with the end of a stick, I obliged them to disperse, but could find no entrance which they concealed, no eggs, no males nor females.

"Especially before a storm, or after a stormy rain, one meets travelling bands of *Eciton.* Their march is generally conducted in excellent order, and with a file of one or two individuals in front. Sometimes, however, the column enlarges itself, scatters and attacks with fury the passer-by, who, by ill-luck, has disturbed the procession. The *E. Mexicana* especially seems naturally very irascible, and the entomologist who wishes to enrich his collection with specimens of this species, must take his time and protect his legs from an attack.

"I only find the individuals with long mandibles (those which Smith calls *major workers*) among the *E. hamata* and *E. Mexicana.* It is difficult to satisfy oneself as to the role which they fill in the community. I have watched with attention the passage of columns of Eciton, but could see nothing to indicate any peculiar attributes to these individuals.

"The Eciton does no harm to agriculture by depriving the

trees of their leaves, like the Œcodoma. On the contrary, it destroys, probably, a host of noxious insects, and so recommends itself to planters; while it merits the attention of entomologists by the singularity of its habits, and the obscurity which yet reigns about its history."

In relation to the duties of these major workers with long mandibles, Mr. Bates writes (British Museum Catalogue of Hymenoptera, Vol. VI, p. 149) of a South American species: "I am quite convinced that these large-headed ones are a distinct order of individuals in a colony of Ecitons, and fulfil some distinct, peculiar functions." "I once saw on a beach a dense column of Ecitons descending from the rocks on one side of the harbor, traversing the beach and climbing again on the opposite side; the length of the column visible was from sixty to seventy yards, and yet there was no appearance of the van or the rear of the army. It was probably a migration, as all the small-headed individuals carried in their mandibles a cluster of white maggots, probably larvæ of their own species." "The large-headed individuals were in proportion of perhaps about five in one hundred to the small individuals, but not one of them carried anything in its mandibles. They were all trotting along outside of the column, and distributed in regular proportion throughout the whole line, their globular white heads rendering them quite conspicuous among the rest, bobbing up and down as they traversed the inequalities of the road."

All of the Ecitons seem to prey upon living objects. It seems probable that animal food is converted into nourishment for their larvæ by comminution, as in other species is the case with vegetable matter. Mr. Bates observes "that with most species observation is a difficult matter, for no human endurance can sustain their overwhelming attacks, the cruel sting and bite of these formidable insects." They generally march in columns. One South American species, the *E. prædator*, hunts in dense masses. "The entire phalanx, when passing over a tract of open ground, occupies

a space of from six to ten square yards; where they pass, all the rest of the insect world is in commotion and alarm. They stream along the ground and climb to the summit of all the lower trees, searching every leaf to its apex." They are often seen with the larvæ and eggs and remains of other ants, doubtless the result of attacks upon their nests. Their own nests have never yet been discovered.

In one case he thus chronicles the result of his examination of *E. legionis*. One evening he discovered a column of them at work. The next day he found them again not far off. They were mining in a bank of light soil, and extracting therefrom a bulky species of Formica, with their larvæ and eggs. It was curious to see them crowding around the orifices of the mines, and assisting their comrades to lift out the bodies of the luckless ants; the latter being too bulky to carry were torn to pieces, and the marauders forthwith started off laden with their booty. "For some distance there were many lines of these moving along the declivity of the bank, but at a short distance these converged. I then traced them to a large and indurated and ancient termitarium; up the ascent of these the Ecitons were moving in a dense column, like a stream of liquid metal; many were now lugging up the bodies of the Formicæ, and the whole disappeared in one of the spacious tubular cavities, which always traverse these old termitaria from the summit to the base."

Pachycondyla. In this genus the node of the peduncle is thickened, cubical, or nearly so, elevated to the same level as the first segment, and usually of nearly the same width. The eyes are small and inserted low down upon the head. The spurs of only the two anterior tibiæ are pectinate. (Mr. Smith says all are pectinate.)

Pachycondyla Orizabana. "It lives at Orizaba in little societies under stones and trunks of trees."

Pseudomyrma. In this genus the first node is elongate, pedunculate, the second large and globose. The antennæ are inserted near together and near the mouth; eyes elongate,

ovate, occupying a large portion of the head. Anterior wings with one marginal and three submarginal cells.

Pseudomyrma bicolor Guérin. (Fig. 8. The hind legs not represented, the specimen being imperfect.) "Mexico. This is also found in Columbia and at Panama."

Pseudomyrma flavidula Smith. Mexico. This is also a South American species. I cannot feel quite sure that it is *P. flavidula*. "Among the quite numerous species of *Pseudomyrma* that one finds in Mexico, one class appears to be solitary (at least, one never meets them except alone) while the others (as is the case in *P. bicolor* and *P. flavidula*) live in greater or less numbers within the spines which arm the stems of certain species of Mimosa. These spines, fixed in pairs upon the branches, are pierced near their extremity by a hole (seen in the cut at *a*), which serves for the entrance and exit of the ants. The interior is hollow and includes some neuters, the larvæ, and, in the season, males and females. The Pseudomyrma generally stings very sharply, and attaches itself with tenacity by its mandibles to the part of the body which it seizes. Although this differs a little in size, one of these species may be considered to be the *P. flavidula* Smith."

Mr. Smith has described a species from Panama (*P. modesta*), "which lives in the hollow thorns or spines of a species of Acacia. The spines are three inches long, tapering to a point from a broad base: the ants gnaw a small hole toward the point of the spine, the broad base then forms an admirable domicile for their young brood. There are no cells or divisions of any kind for the reception of the eggs or larvæ. The number of pupæ found in one nest was twenty-nine, and there were about twenty mature ants. All of these were workers. The pupæ were not inclosed in cocoons."

Pseudomyrma thoracica. "Cordova. In the trunks and under the bark of trees, in societies which are sometimes very numerous."

Two other species of Pseudomyrma from South America have been observed by Mr. Bates, *P. oculata* and *P. termitaria*, which construct their dwellings in chambers in the outer walls of the tunnels of different species of Termes, or white ants. Still another species, with small colonies, constructs its formicarium in the pith-tube of dried twigs. From this variety of habits there would seem to be no definite rule laid down for the genus, as in Formica and Myrmica. Each species or group of species must be studied separately, although the whole genus may meet on common ground, as to its manner of procuring food and mode of transformations.

The genus *Atta* has two nodes in the peduncle. The wings are larger than the body, with one marginal and three submarginal cells, the third sometimes incomplete, the second bell-shaped. The large workers have greatly developed heads, and the corslet, or thorax, is without spines. This genus belongs to the subfamily Attidæ of Mr. Smith.

Atta clypeata Smith. (British Museum Catalogue of Hymenoptera, Vol. VI, p. 169.) Mr. Smith describes only the male and female. The worker minor from Orizaba, Mexico, agrees tolerably well with the description.

Another genus of this group is *Œcodoma.* It differs from Atta externally, in having the corslet armed with spines, and in the fore wings are two submarginal cells, the second being incomplete.

Œcodoma Mexicana Smith. (Fig. 9, female; 10, worker major.) (British Museum Catalogue of Hymenoptera, Vol. VI, p. 185.) "This species is unfortunately too abundant in Mexico, in the temperate departments of the gulf coast, such as those of Orizaba, Cordova, etc. The neuters are known in Mexico under the name of *arrieras*, or *hormigas arrieras*, from the similarity presented by their marching

columns to a caravan of muleteers. The male and female bear the name of *Ticatanas*. In many places the natives eat the abdomen of the females after having detached the thorax.

"It is specially in the argillaceous countries that the Œcodomas build their enormous formicaries, so that one perceives them from afar by the projection which they form above the level of the soil, as well as by the absence of vegetation in their immediate neighborhood. These nests occupy a surface of many square metres,* and their depth varies from one to two metres. Very many openings of a diameter of about one to three inches are contrived from the exterior, and conduct to the inner cavities which serve as storehouses for the eggs and larvæ. The central part of the nest forms a sort of funnel, designed for the drainage of water, from which, in a country where the periodical rains are often abundant, they could hardly escape without being entirely submerged, if they did not provide for it some outlet.

"The system which reigns in the interior of these formicaries is extreme. The collection of vegetable debris brought in by the workers is at times considerable. But it is deposited there in such a manner as not to cause any inconvenience to the inhabitants, nor impede their circulation. It is mostly leaves which are brought in from without, and it is the almost exclusive choice of this kind of vegetation which makes the *Œcodoma* a veritable scourge to agriculture. At each step and in almost every place in the elevated woods as in the plains, in desert places as well as in the neighborhood of habitations, one meets numerous columns of these insects, occupied with an admirable zeal in the transportation of leaves. It seems even that the great law of *the division of labor* is not ignored by these little creatures, judging from the following observations which I have often had occasion to make.

"The ground at the foot of the tree, where a troop of these

* A metre is about thirty-nine (39.37) inches.

arrieras is assembled for despoiling it of its leaves, is ordinarily strewn with fragments cut off with the greatest precision. And if the tree is not too lofty, one can satisfy himself that a party of foragers, which have climbed the tree, occupies itself wholly in the labor of *cutting them off*, while at the foot are the *carriers* which make the journeys between the tree and the nest. This management, which indicates among these insects a rare degree of intelligence, is perhaps not a constant and invariable practice, but it is an incontestible fact, and one which can be constantly proved.

"The part of the inhabitants which may be called the *workers*, is composed of wingless individuals of quite variable size. The largest (*workers majores* of Smith) are distinguished from the others at first sight by the great enlargement of the head, and the presence of a single ocellus upon the face. Some travellers have attributed to these *grosses-têtes*, a superior share of intelligence, and represent them as exercising a kind of surveillance over the other members of the community. I avow that I cannot come to a like conclusion, for I have always seen them devote themselves to the same labors of cutting off and transporting the leaves, etc., and this without indicating a higher development of instinct in any way. Probably their special role, if they have one, is borne in the excavation of the nest and in tunnelling the galleries, labors which demand a superior strength and better implements.

"The nest of Œcodoma serves as a habitation for many parasitic lodgers: some serpents, and particularly certain insects, which there undergo their metamorphoses. In digging up their nests in the spring, one never fails to find there some large species of Scarabæides. One also very often sees a great number of males of a wasp, *Elis costalis* Lep.,*

* Perhaps, and it is an interesting question which I have not yet had an opportunity to solve, the females of Elis deposit their eggs in the bodies of the larvæ of Scarabæus. At Tehuacan (Dep't of Puebla) where the *Scolia Azteca* Sauss. is very common, it is particularly abundant in the leather tanneries, which leads me to think that the females of this species also deposit their eggs under the epidermis of the larvæ which abound

flying about these nests, and resting themselves upon the dead branches which happen to be there, thus, I feel well assured, awaiting the coming forth from these of the females of their species which have entered into the formicary.

"At the commencement of the rainy season, after the first storms of the season, the Œcodoma begins the work of reproduction. The union of the sexes probably takes place during the night, for in the morning one finds the neighborhood of the formicary strewn with the dead bodies of the males and the females, the latter already fertile, from whom the workers make it their duty to tear away their wings.

"The ravages committed by the Œcodoma* in inhabited places, both by the surface which their nest removes from cultivation, and by the number of trees which they despoil of their leaves, are at times considerable, and demand very great watchfulness on the part of the cultivators. They have essayed a thousand ways to put an end to the havoc which these cause. The only mode which offers a sure chance of success is the removal, the extraction of the whole nest. For this purpose they dig a trench of sufficient depth around the whole, then carry away the dome or hillock and the walls of the nest, until, arriving at the cells of the larvæ, they destroy them and also the eggs. The perfect insects which escape the ruin of their colony then disappear never to return.

"The coffee plantations, which demand a light soil, are frequently chosen by the *hormigas arrieras* as places in which to construct their nests; and one can easily imagine the loss which they cause to the proprietors, if these last do not con-

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in the tan. [The *Scarabæus* is a large insect allied to our June beetle. Scolia is a wasp allied to Elis; neither have been supposed hitherto to be parasitic insects. Their habits thus probably ally them with the Ichneumon fly.—EDS.]

*"At least the Œc. Mexicana, for the *Œc. hystrix*, which also I have found isolated in the forests of the hot region, is too rare to be named as doing any damage." It may be well to add that Orizaba is in the temperate, Cordova between the temperate and hot, and Tehuacan in the cold regions or zones of Mexico. Mr. Bates remarks of the Œc. hystrix that he once "found a vast number in a low meadow, carrying away fragments of fallen fruit, but none of the large-headed individuals. This was in Brazil."

tinue an active and daily surveillance over the manœuvres of these insects."

It seems desirable to add the testimony of Mr. Bates as to the *Œc. cephalotes*, the common species of South America. "This insect, from its ubiquity, immense numbers, eternal industry, and its plundering propensities, becomes one of the most important animals of Brazil. Its immense hosts are unceasingly occupied in defoliating trees, and those most relished by them are precisely the useful and cultivated kinds. They have regular divisions of laborers, numbers mounting the trees and cutting off the leaves in irregularly rounded pieces the size of a shilling, another relay carrying them off as they fall." "The heavily laden fellows, as they came trooping in, all deposited their load in a heap close to the mound. About the mound itself were a vast number of workers of a smaller size. The very large-headed ones were not engaged in leaf-cutting, nor seen in the processions, but were only to be seen on disturbing the nest." Mr. Bates says, "I found, after removing a little of the surface, three burrows, each about an inch in diameter; half a foot downward, all three united in one tubular burrow about four inches in diameter. To the bottom of this I could not reach when I probed with a stick to the depth of four or five feet. This tube was perfectly smooth and covered with a vast number of workers of much smaller size than those occupied in conveying the leaves; they were unmixed with any of a larger size. Afterwards, on probing lower into the burrow, up came, one by one, several gigantic fellows, out of all proportion larger than the largest of those outside, and which I could not have supposed to belong to the same species. Besides the greatly enlarged size of the head, etc., they have an ocellus in the middle of the forehead; this latter feature, added to their startling appearance from the cavernous depths of the formicarium, gave them quite a Cyclopean character."

Of another species, the *Œc. sexdentata*, Mr. Smith quotes

from Rev. Hamlet Clark, that at Constancia, Brazil, the proprietor of a plantation used every means to exterminate it and failed. "Sometimes in a single night it will strip an orange or lemon tree of its leaves; a ditch of water around his garden, which quite keeps out all other ants, is of no use. This species carries a mine under its bed without any difficulty. Indeed, I have been assured again and again by sensible men, that it has undermined, in its progress through the country, the great river Pariaba. At any rate, without anything like a natural or artificial bridge, it appears on the other side and continues its course." This testimony is confirmed by Mr. Lincecum (Proceedings of Academy of Natural Sciences, Philadelphia, 1867, p. 24) in an interesting account of the *Œc. Texana*, which he has observed for eighteen years. He states that they often carry their subterranean roads for several hundred yards in grassy districts, where the grass would prove an impediment to their progress. On one occasion, to secure access to a gentleman's garden, where they were cutting the vegetables to pieces, they tunnelled beneath a creek which was at that place fifteen or twenty feet deep, and from bank to bank about thirty feet. He also observes that the smaller workers which remain around the nest do not seem to join in cutting or carrying the leaves, but are occupied with bringing out the sand, and generally work in a lazy way, very differently from the quick, active leaf-cutters. Also that the pieces of leaves are usually dried outside before being carried in, and that if wet by a sudden shower are left to decay without. He also thinks that their lives are dependent upon access to water, and that they always choose places where it is accessible by digging wells. In one case, a well was dug by Mr. Pearson for his own use, and water found at the depth of thirty feet. The ant-well which he followed was twelve inches in diameter.

The genus *Cryptocerus* belongs to another subfamily, *Cryptoceridæ*, founded on the form of the head, which is

more or less flattened above, with the sides expanded into flattened marginal plates, concealing or partly hiding the eyes. The peduncle consists of two nodes, the corslet is spinose, and the face is grooved in front for the reception of the antennæ.

Cryptocerus laminatus Smith. (Journal of Entomology, 1860, p. 77.) Brazil. "This species lives at Cordova, in the same places as the next, but it is rarer and more solitary."

Cryptocerus multispinosus. (Fig. 11.) This is the most common species of Cryptocerus in the environs of Cordova, where it lives in the trunk of certain trees, especially those of the Croton sanguiferum, Cedrela odorata, Spondias chilias,* etc. These ants show little vivacity, remaining stationary a good part of the day at the entrance of the holes which conduct to their nest. In the middle of the day one sees them running about fallen trunks, without apparent order or aim. When one attempts to seize them, they elevate the abdomen while running, after the manner ascribed to another kind of ant, the *Crematogaster Montezumia.*

NOTE.—The new species mentioned in this paper will soon be described in the Proceedings of the Essex Institute.

EXPLANATION OF PLATE II.

Fig. 1. *Formica fulvacea*, worker major.
Fig. 2. *Tapinoma tomentosa*, worker.
Fig. 3. *Polyrhachis arboricola*, worker; *a*, side view of thorax and abdomen.
Fig. 4. *Ectatomma ferruginea*, worker; *a*, side view of the peduncle of the abdomen.
Fig. 5. *Eciton Mexicana*, worker major; *a*, front view of the head.
Fig. 6. *Eciton Mexicana*, worker minor, with a front view of the head.
Fig. 7. *Eciton Sumichrasti*, worker minor.
Fig. 8. *Pseudomyrma bicolor*, worker.
Fig. 9. *Œcodoma Mexicana*, female.
Fig. 10. *Œcodoma Mexicana*, worker major.
Fig. 11. *Cryptocerus multispinosus*, worker.

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*These are local names for Mexican plants.

NORTON ON MEXICAN ANTS.

THE MOTTLED OWL IN CONFINEMENT.

BY C. J. MAYNARD.

[The following interesting account of this bird was sent me for insertion in my "Birds of North America," which I have in preparation. As it throws considerable light on the disputed question of the color of the bird's plumage in the first year, I send it to the NATURALIST, hoping that it may bring out, from other observers, new facts in relation to this species. In presenting it, I will briefly say that I have found two other birds in the first year's plumage which were decidedly gray; but these are the only instances that I have noticed, although I have examined a great number of specimens. Whether we have two species of *Scops*, or whether the young of *S. asio* are sometimes gray in color, sometimes red, remains still uncertain. My own opinion is that the last hypothesis is the most correct.—E. A. SAMUELS.]

ON June 15, 1867, I observed some boys around a small owl which was perched on a stick. On closer examination I found that it was a young Mottled Owl (*Scops asio* Bonaparte). It was staring about in a dazed manner and seemed half stupefied. I easily persuaded the boys to part with it for a trifle, and took it home. I should judge that it was about two weeks old. It was covered with a grayish down. I put it in a large cage, and gave it some meat which it ate, but not readily, for it seemed frightened at the sight of my hand, and at my near approach would draw back, snapping its beak after the manner of all owls. It soon grew tamer, however, and would regard me with a wise stare, as if perfectly understanding that I was a friend.

In a short time it would take food from me without fear; I never saw it drink, although water was kept constantly near it. Its food consisted of mice, birds, and butchers' meat, on which it fed readily. I kept the bird caged for about two weeks, during which time it became quite tame, but would not tolerate handling, always threatening me with its beak when my hands approached it. As the wires of its cage broke its feathers when moving about, and as it hardly

seemed resigned to confinement, I opened its cage and gave it the freedom of the room, leaving the windows open night and day. About this time I gave it the name of "Scops," to which in a little while it would answer, when called, with a low rattle, which sounded like the distant note of the kingfisher.

One morning Scops was missing; diligent search was made for it, but no owl could be found, and, reluctantly, we gave it up for lost. Once or twice it was seen in the neighboring woods by different people, and once on the roof of a barn, but was wild and refused to be caught. It had been absent about a week, when, one morning, I was told that my owl was out in the yard. I hastened out and found a half-grown Newfoundland dog playing with my pet. The owl was clinging to his shaggy fur with its claws, snapping its beak, and biting fiercely. I immediately rescued poor Scops and carried it into the house. It was raining hard, and the bird was wet through. On arriving in its old quarters it seemed pleased, chuckling to itself after its manner. It was almost starved, and ate two full-grown blue-birds at the first meal. After this time I gave it the privilege of going and coming when it pleased, but, mindful of its former experience, it never has but once remained away more than two days at a time. It now became more attached to me than ever, and will, at this time, permit me to pat it gently.

When a bird is given it for food, it takes it in its claws, and with its beak invariably pulls out the wing and tail feathers first, then eats the head, then devours the intestines; then, if not satisfied, it eats the remainder of the bird, feathers and all.

That this owl sees tolerably well in the daytime I have proved to my satisfaction. I caught a mouse and put it alive into an open box about two feet square. This I placed upon a bench near Scops, who was attentively watching my movements; the moment it saw the mouse, the owl opened its eyes wide, bent forward, moved its head from side to

side, then came down with an unerring aim, burying its talons deep in the head and back of the mouse. Looking up into my face, and uttering its rattling note, as if inquiring, "Is'nt that well done?" it flew up to its perch with its struggling prey grasped firmly in its talons, where it killed the mouse by biting it in the head and back. During the whole act it displayed considerable energy and excitement.

Again, I have seen it pounce on a dragon-fly which was unable to fly, but laid buzzing on the bench; the bird went through the same manœuvres as before, striking the dragon-fly with the greatest precision, and with both feet. I think that these instances prove that the bird can see nearly as well in the day as in the night. In both the above instances the sun was not shining on the objects struck, but they were very near the window, and the light was consequently strong.

Scops will, in taking birds from my hand, almost always look up in my face and utter its subdued rattle. In sleeping, it usually stands on one foot, both eyes shut, but sometimes stretches out at full length, resting on its breast. When sound asleep it awakes instantly on its name being pronounced, and will answer as quickly as when awake. I have heard it utter its peculiar quavering note on one or two occasions, which, notwithstanding its reputed mournfulness, has much that sounds pleasant to my ears. When moving along a plane surface, Scops progresses, with a half walk, half hop, which is certainly not the most graceful gait possible.

When out at night among the trees Scops acts in much the same manner as when in the house, hopping from limb to limb, looking about with a quick, graceful motion of the head, sometimes turning the head around so that the face comes directly behind.

When it returns to the house in the morning, daylight is often long passed, and even sunrise. The alarm note is a kind of low moan; this was often uttered at the sight of a tamed

gray squirrel (but with which it has now become better acquainted), and always at the sight of its old enemy, the dog.

While flying, Scops moves through the air with a quick, steady motion, alighting on any object without missing a foothold. I never heard it utter a note when thus moving. When perching, it does not grasp with its claws, but holds them at some distance from the wood, clasping with the soles of the toes. When it has eaten enough of a bird, it hides the remaining portions in any convenient place near by; if its hiding-place is then approached, the owl from its perch watches the intruder jealously, and when its hidden spoils are touched, it lays back its ear-like tufts, snaps its beak once or twice, and drops down on the unlucky hand like an arrow, striking it with its sharp claws until the hand is withdrawn; then, ascertaining that its treasure is safe, Scops resumes its perch, looking at its late disturber with most unfriendly eyes.

Sometimes in the daytime it will take a sudden start, flitting about the room like a spectre, alighting on different objects to peer about, which it does by moving sideways, turning the head in various directions, and going through many curious movements; but it always returns to its perch and settles down quietly.

I once placed a stuffed owl of its own species near it, when it ruffled its feathers, gave a series of hisses, moans, and snappings of the beak, and stretched out one wing at full length in front of its head as a shield to repulse what it took to be a stranger invading its own domains. As the stuffed bird was pushed nearer, Scops budged not an inch, but looked fiercer than ever; its ruffled back-feathers were erected high, its eyes sparkled, and its whole attitude was one of war.

Some time since the building in which my pet was kept was torn down, and the bird was absent for two weeks; but a new building has been erected near the site of the old one, and to-day I found Scops in the new cellar, sitting on a pro-

jecting stone of the wall, as much at home as in the old place. From this it can be seen that its affection for locality is very strong. Notwithstanding Scops' long absence it is as tame as ever, taking its food from my hand, and behaving in the old manner. Its plumage at this time (Oct. 31, 1867) is perfect, most of the feathers having recently changed. It is mostly *gray;* there are but few marks of red, and but a faint wash of cream-color on the back, *not red.*

In your book on the "Birds of New England" are given two instances of this bird's first plumage being in the *red;* but my bird's is decidedly in the *gray.* If it is red at all, it must be at some time hereafter. You also mention one occurrence of the young bird in the gray plumage, and, to give an additional example, I would, for the benefit of students, add one from my own experience.

ROCK RUINS.

BY A. HYATT.

I WAS accosted once by a gray-headed patriarch, sitting at the door of his farm-house, with these words: "I have heard of you, and wished to see you; my neighbors tell me that you are a rock-hunter." After many questions he continued: "I have read nothing but this,"—holding up the well-thumbed family Bible,—"and seen nothing but that," —pointing to the extensive landscape the house afforded,— "and yet," said he, "a long life spent with them both before me, has given me more to think about than I can master. The rains pour down their floods upon these hills till every little hollow holds a muddy rivulet which empties into that silver thread you see yonder, until it too is a broad, yellow current. It has struck me, stranger, that those rains, in the hands of the Almighty, are the instruments which have cut

and shaped these hills about us, and that great valley yonder. Do you men who study rocks think so too?"

The old man, without other help than his own eyes and an appreciative love of nature, fostered by the daily contemplation of a fine landscape, had unconsciously retraced the primary steps of geological history, and rediscovered the fact that water is one of the great agents of change upon the earth's surface.

He had seen it working, and comprehended how it was slowly, but with irresistible power, melting down hills, furrowing out valleys, and casting the muddy flow through a thousand channels into the sea. The patient contemplation of a view such as one often meets with,—a quiet valley sleeping between parallel ranges of hills, with wrinkled sides and bald summits, had taught him this.

When we should wish, however, to describe the effect of water upon the face of our continent, it is not best to begin with such complicated examples, but good sense dictates the introduction of a few special cases wherein water is evidently the sole agent of change. Thus a ladder is presented to the mind by which it may climb to the comprehension of the panorama, instead of being presented at once with general laws, and then carried down backward upon the rounds of fact and explanation.

Perhaps but very few of the thousands who annually reach that Mecca of the travelling public, Niagara, are aware that it furnishes one of these examples, and is so often a theme for geological writers and lecturers. Visitors pay the extortionate prices of admission to its various points of view, are made giddy by the mad whirl of the rapids, stunned by the roar of the water, and awe-struck by the vibrations of the earth, and yet do not intelligently comprehend the meaning of all this turmoil and uproar. They read in the guide-books the meagre notice of the fact, that the cataract was once at Lewiston and has eaten its way back through the solid rock to its present position. Some accept the state-

ment as children a fairy tale, some doubt without the ability to give a valid reason, and some, fearing the sudden destruction of their dream-land, refuse to analyze the glories of the river. They shrink from familiarity with nature, lest water should prove itself nothing but water, and stone nothing but stone, entirely ignorant of the fact, that the close observer, whether poet, artist, or naturalist, is the only one who seeks the spirit of the beautiful with success. He alone grasps the internal creative thought, the soul embodied in the landscape, without which the rocks, rivers, and mountains, with their green garlands, are comparatively expressionless forms, like faces without eyes.

Along the sides of the gorge at Niagara a few of the great layers which make up the body of the continent are seen rising one after another, overlapping at the surface like tiles on a nearly horizontal roof;* the inclination of the layers, in fact, being only about twenty-five feet to the mile, in a southerly direction.

Out of the cloud and foam of the cataract appear two layers, each about eighty feet thick, the upper one (8) of limestone, the under (7) of shale. Still farther northward, above the debris that has accumulated at the foot of the cliffs, runs a thinner layer of limestone (6), and, continuing in the same direction, we find a layer of green shale (5) succeeded soon by one of light-colored sandstone (4), and lastly a mass of red sandstone (3).

Thus, when we reach Suspension Bridge it is comparatively easy even for an unpractised eye to analyze the cliff. Attracted by the emerald curtain of the great fall, few vouchsafe more than a passing glance down the chasm, and yet in autumn this view is one of rare beauty. The alternate bands of color in the rocks blend with the fringe of golden and scarlet trees upon the *talus* at their feet, and from every crevice graceful vines hang their lace-work of flaming foliage. The painted walls and their gorgeous ta-

* Vide 8, 8', 9, and 10 in the wood-cut.

pestries rise nearly three hundred feet on either side, and, at that dizzy depth, the river glides on, a flood of green and silver, till the harder rocks in the shallower channel beyond obstruct the current and hurl its waves fifteen feet in the air.

Below the whirlpool these harder rocks appear as a light-colored, gritty sandstone (2), underlaid by a soft red sandstone (1). Even to the most superficial observer it is evident that all these layers were at one time continuous and filled the gorge, just as it is now apparent that the higher limestone and shale are continuous under the fall (*d*, *f*).

The recession of the present falls is an established fact. Father Hennepin, one of the early French explorers, described and figured Niagara as early as 1678. Then it had three distinct parts instead of two, as at present. On the Canada side a tabular rock of great size extended out interrupting and turning a portion of the overflow in an easterly direction, making a third fall at right angles, but continuous with the horse-shoe. About seventy years afterwards, a Danish naturalist, Kalm, records the disappearance of this rock, and describes the fall as having about the same general outline as at present. His sketch, however, does not differ materially from Father Hennepin's, except in the absence of the third fall. Parts of Table Rock fell successively in 1818, 1828, and 1829, and Kalm speaks of the descent of portions of this rock, which extended under the water previous to his visit in 1750.

All these changes were on the Canada side, and, as has been already noticed by Professor Jules Marcou, that part of the cataract recedes the most rapidly. The volume of water is much greater, some twenty-five feet in depth in the centre of the horse-shoe curve, and the mass of debris, which is so picturesque along the base of the American side, is entirely wanting, the layers of rock being carved out perpendicularly, probably to a considerable depth below the surface

of the river. Professor Jules Marcou, who visited Niagara in 1848–49 and 1850, remarked not only the changes which occurred in the Table Rock,* part of which fell in 1850, but observed also the increasing angularity of the curve at the centre of the horse-shoe, and the gradual deepening of the water. It seems certain that either the size of the river has greatly decreased since Father Hennepin's visit, or else this part of the horse-shoe fall is much deeper and the sides shallower than formerly. In 1850, according to Professor Marcou, the curve was passably regular; in 1863, it was very much deeper, and notched near the centre. He also noticed that a large block, some six or seven feet in diameter, which had stood near the Terrapin Tower, had been engulfed, and together with it a long line of boulders figured by Professor Hall in his map of 1842. In 1852, portions of the cliff at this point fell, making a sensible difference in its outline, and probably caused the disappearance of the boulders.

The manner in which the tables of rock are undermined is as well known as the recession of the cataract itself. Every visitor is informed that the water, dashing against the lower layer of soft shale (7), cuts out cavernous hollows like the "Cave of the Winds," and presently the projecting tables of limestone above (8), becoming too weak to support themselves, and the great weight of the river, are precipitated in immense masses to the bottom.

These huge fragments, with every point and fractured edge rounded and smoothed by the ceaseless bombardment of the water, lie in huge piles under the American fall. There is no continuous flow, but a succession of blows, and one standing near them, feeling this distinct pulsation, as wave after wave rushes over the precipice and descends with a deafening roar upon the polished surfaces, no longer wonders that the rocks are worn slippery, but rather that they

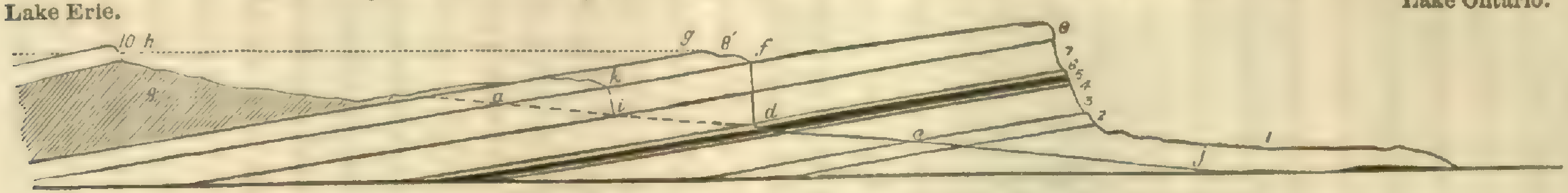
*This is a tabular extension of the upper limestone on the Canadian side close to the cataract. It once extended out some distance, and was probably the last remnant of the lateral precipice over which the third fall turned in Father Hennepin's time.

are not shattered like brittle glass under a trip-hammer, and swept away.

We must, however, even before this exhibition of power, remember that water is not the only instrument which is carving out the softer shales. Wherever these are uncovered, as in the "Cave of the Winds," they are cased in ice during the winter. Experience has taught us all how the frost loosens the bricks of the side-walks, throws down massive stone-walls, and bursts our water-pipes. All these effects are not due to any miraculous power possessed by frost, but to the fact that water when freezing expands and forces room for its increasing volume. In the crevices of the shale it acts quietly but with resistless force between the layers, like millions of minute wedges lifting and loosening the edges of the rock-beds, which are thus rendered an easy prey to the waves, if they do not fall of themselves in the early spring. Goat Island recedes almost as fast as the cataract itself, and yet frost alone is the workman that undermines its rocky face.

The future of the cataract may be read in the structure of the rocks, as well as its past. Professor Hall, who has studied it more carefully than any other geologist, predicts that Niagara is slowly but surely destroying itself. Thousands of years hence and the cataract will have eaten its way back until the solid limestone layers, which are now on its verge, will be at its base (*i*, *k*). Here it will probably remain for a long time almost stationary. The lower portion being as hard as the upper, will not be eaten out into caves and hollows as at present, but, being less exposed, will give way even more slowly than the upper limestones. These last, however, notwithstanding their hardness, will be gradually worn down, as the hard layers (2) are at the whirlpool (*c*), or the limestones on the bed of the stream above the present fall (8′) to the ascending level of the river bed, as at *d* in the wood-cut. The softer layers of greenish marl, marked 9, will have been already levelled,

Section of the strata along the Niagara River, from Lake Ontario to Lake Erie.



EXPLANATIONS.

1, Red shaly sandstone and marl, which may be seen in the bank of the river at Lewiston (*j*).

2, Gray quartzose sandstone.

3, Red shaly sandstone like No. 1 (with thin courses of sandstone near the top).

4, Gray and mottled sandstone, constituting, with those below, the Medina Group.

5, A thin mass of green shale.

6, Compact gray limestone, which with No. 5 constitutes the Clinton Group at this place.

7, Soft argillo-calcareous shale.

8, Limestone.

8′, The upper thin-bedded limestone, which, together with 7 and 8, constitutes the Niagara group.

9, Onondaga salt group of shales and marls, including the hydraulic limestone, or beds of passage to the next rock.

10, Onondaga and Corniferous limestones.

All these layers, from 1–10 inclusive, belong to the upper Silurian system.

h, g, f, d, c, j, This line represents the present surface of the river from Lake Erie to Lewiston, a distance of about twenty-one miles.

h, g, The present surface of the river, between Lake Erie and the Falls.

d, f, The perpendicular fall, over the Niagara limestone and shale.

f, g, The rapids, where within a mile there is a descent of fifty-two feet over the upper thin-bedded portion of the Niagara limestone.

c, The whirlpool.

d, c, j, Present level of the river where it has cut its way down through all the layers from 1 to 8′ inclusive.

i, k, The position of the falls and rapids after a recession of two miles.

a, i, d, Future level of the river bed, as the falls gradually wear away the rocky layers.

The cut and most of the explanations are from Professor Hall's Report on the Geology of New York.

and Niagara, with perhaps a slight descent over the limestones (10) at the outlet of Lake Erie, will be uninterrupted in its course to Lake Ontario.

According to the estimate of Sir Charles Lyell, about thirty-five thousand years ago the falls were at Lewiston. Now they are seven miles away, and have yet two miles to traverse, each step harder and more difficult as the shale becomes thinner, before they reach the point (*i*), where, should they preserve their present structure, they will not be over one hundred feet high. Following out Sir Charles Lyell's estimate, this would take ten thousand years, even if no allowance was made for the gradual retardation caused by the disappearance of the shale. Although these calculations are based upon the observed rate of retrogression of the falls, they can only be very rough approximations, until sufficient time has elapsed for other observations to be made and compared with the monuments erected by Professor Hall in 1842. They are, however, sufficiently close and reliable to show that Niagara was not carved out in a day, nor yet in a thousand years; but that for tens of thousands of years the steady rush of the river has ground the rocks to powder, and swept away, piece by piece, the solid layers, until the gorge it has cut is now seven miles long, from two to three hundred and fifty feet deep, and eight to twenty-four hundred feet wide at the top.

Of late, the public have been alarmed by the statement that about half a mile back of the horse-shoe, the motions of the stream indicate a breach in the upper limestone, and speculations are indulged in that through this hole a subterranean stream is eating away the underlying shale with great rapidity. The sagacious inhabitants, who have given birth to this story, predict the probable destruction of the great cataract by the caving in of the tables of limestone (8′) with such rapidity that the whole will form only a rapid. It is difficult to understand, first, how such a breach could have been made; second, how if made it could swallow

enough of the river to eat away any considerable portion of the shale underneath; and third, if it did both of these impracticabilities, how the subterranean stream could break down the face of the fall faster than the water could carry off the fragments and maintain the face of the precipice perpendicular. We do not desire, however, to deprive either the guides or the oldest inhabitants of their time-honored privilege of astonishing the public, but they should remember and take warning from the fate of the "reliable contraband;" they may, even as he did, lose their hold upon the credulity of the public.

THE CRUISE OF THE "ABROLHOS."

BY C. FRED. HARTT.

RECIFE DO LIXO, ABROLHOS, AT LOW TIDE.

After one has travelled up and down the Brazilian coast and become familiar with the long sea-beaches, bordered with ridges or domes of sand, that almost uninterruptedly stretch from the Amazonas to Cape Frio, and with the ever-thundering Atlantic surf that draws its foamy line around those lonely shores, it seems strange to see at Caravellas a

coast scarcely elevated above the water, and a beach washed by a sea as quiet as an inland lake. The water here along shore is very shallow, owing to the very gentle slope of the bottom, and not only for that reason is it quiet, but because very extensive reefs, lying between the main-land and the islands of the Abrolhos, break the force of the waves, and protect the coast.

I hired at Caravellas, for the exploration of the Abrolhos region, a little launch, the *Abrolhos*, and three men, the captain being a Dane, who for many years had followed the life of a fisherman among the Abrolhos reefs, and, as it will hereafter be seen, knows them perfectly.

It was a glorious morning early in last September, the month that closes the Brazilian winter, that we embarked. Up went the long, narrow, triangular sails to the short masts, Jacó blew from his big horn a few cornet-like notes, that went breaking with strange echoes through the cocoa-palm groves on the river bank below the town, and we dropped down stream. Next day, for we had been delayed at the mouth of the river, we were beating by dawnlight out of the entrance. After sticking fast on a sand-bank or two, we soon stood off towards the islands. Near the shore the water was very turbid and reddish; but leaving the land it soon became clearer, and the yellowish tint gave way to green. The sounding-line showed a depth of about sixteen metres, with a white sandy bottom, which gave to the sea a whitish appearance. There was not a cloud in the sky, and the low sun looked warmly down on the waves rippling under the last breath of the dying land-breeze.

About seven miles from the land I observed that the water ahead was spotted by dark brownish patches of color, irregular in outline, and resembling the shadows cast by little clouds. Occasionally one might mark the breaking of a wave over one of these patches. "These are the Chapeirões,"* said Jacó. This is the name given in Brazil to

* Pronounced *Shăpayrŏĕngs.* The singular is "Chapeirão," pronounced *Shăpayróung.*

isolated coral structures, which are very common on the Brazilian reef-grounds. Corals grow over the bottom in small patches, and without spreading much, rise often to a height of forty to fifty or more feet, like towers, and sometimes attain the level of low tide. At the top they are usually very irregular, and sometimes spread out like mushrooms, or, as the fishermen say, umbrellas. Some of these Chapeirões are only a few feet in diameter. Two Chapeirões are seen in the foreground of the engraving of the Recife do Lixo. Professor Verrill tells me that similar structures occur also in the West Indies. We soon came up to one and passed almost over it. They were of all heights, and on the larger the waves were breaking. The sea was full of them, a perfect labyrinth, through which our skilful captain readily tacked his way. In some places a good-sized ship might sail among them, but it would not be safe to venture among them in dark or stormy weather. As we threaded our way through, Jacó and the sailors told me stories of the whale and other fisheries carried on here, of their adventures while engaged in their hardy pursuits in these waters, and how vessels sometimes ran on the Chapeirões, sticking fast by the middle of the keel, to the amazement of the captain, who found deep water all round, the vessel being perched, as it were, like a weather-cock on the top of a tower. Occasionally, I am told, the shock is sufficient to break off and upset some of the slender ones, for they are not very compact.

After a while we came out once more into open water. The reef-ground we had crossed is known as the Parêdes, or *walls*. From north to south it is fifteen to twenty miles in length, while its width varies from three to nine miles. Where we crossed it, nearly in the middle, there are only Chapeirões; but farther north, as well as farther south, there are extensive reefs laid bare at low tide over an area of many square miles; but these I did not visit until my return voyage.

On finishing my examination of the islands, of which I

have already given a description in my last article, I set out on the evening of the 12th of September to visit the northernmost reef of the Parêdes, called the *Recife do Lixo.* My plan was to cross the reef that night at high tide, and anchor in a sac or little bay on the western side, so as to profit by the low tide of the full moon of the morrow. Eastward of the islands a few miles, with a length of about nine to ten miles, and a breadth in some places of four miles, is an area over which Chapeirões grow very abundantly, forming obstructions on which many a vessel has been wrecked. They unite nowhere to form a large reef, and are rarely anywhere uncovered at low tide.

Ordinarily, vessels and steamships go outside of these reefs to the eastward, in sight of the islands. It is not easy, however, to calculate one's distance from a point at sea, and especially from a light by night, and many vessels, notwithstanding the light-house, have been wrecked upon them. West of the islands there is deep water, there are no Chapeirões, and between the islands and the Parêdes there is a channel about eight miles in width, with plenty of water and no obstructions. The safest way is to pass to the westward of the islands, when one may run close in shore, so long as the course is north or south. There is then no danger whatever, and there is a smoother sea. On the return voyage from Rio, the American steamship "South America" was, at the suggestion of the writer, taken through this channel.

Varying winds drove the launch "Abrolhos" into the region of the Chapeirões to the north-eastward of the islands. Jacó and I took turns in heaving the lead. Among the Chapeirões we found a depth of sixteen to twenty metres, and once, while becalmed, we found twenty metres alongside one Chapeirão, and three metres on top. Waiting for the wind, the hooks were used, and we soon had, floundering about below among my boxes of corals, some fine *Guaroupas.* By and by the wind freshened and we set out to cross the channel, sounding all the way, finding a depth of seven-

teen to twenty-nine metres, a bottom composed of sand and shells, and no impediment to navigation. The almost full moon made the night wellnigh as light as day.

Late at night I turned in below, and, with the sound of waves outside and the wash of the bilge-water and the occasional floundering of the not yet dead fish inside, dreamed of home, while Jacó and the men ever and anon heaved the lead, calling out the number of metres. At last the voice of a sailor was heard at the hatch, "*O Seu Carlos! O recife!*" The reef! I went hastily on deck in the moonlight. Splash went the lead. "*Dous metros*,"—only two metres of water. We are on the reef. I rolled myself in my great coat and stretched myself out on the deck listening to the splash of the lead, and gazing at the big cumulus clouds, lit up by the moon, and memory carried me back to long rides along the sea-beaches farther south, to many a bivouac under the clear dewy sky, when the slow march of the tardily gliding hours was marked by the sinking of the moon among the waving, glistening, giant fronds of the cocoa-palm, or by the Southern Cross, that, like a great hour-hand, swung round the southern pole, and with the monstrous *modinha* of the steersman I fell asleep.

"*Dez metros!*" cries Jacó, "O Carlos! we are in the channel." The great reef of the Parêdes is deeply indented, according to fishermen, by two very irregular channels, which, entering it from the north, almost separate it into three parts, very much as the island of Cape Breton is cut up by the Bras d'Or. We had crossed the outer reef and reached the eastern channel, which is very narrow. In this way, with the sounding-line in hand, we crossed the reef, and anchored just on the inner side to wait for the morning.

The sun rose and Jacò wound his horn. Here we were just off the reef and alongside the sac for which we had steered. As the tide went down, the reef began to uncover itself, and became dry over a very large area, as far north and south as we could see from the deck of our little vessel.

As soon as the falling tide had sufficiently defined our little harbor, we sailed in, and anchored close to the reef. I took a basket with cans and bottles, and leaped on the reef, taking with me two men with a *taraffa*, a kind of round casting net, to take fish in the pools.

The reef, exposed at low tide, was level on top, and the corals, as at the Abrolhos, were generally dead and covered by barnacles, etc. It was exceedingly irregular and rugged in outline, and deeply indented by little bays. On the surface were many large pools (see sketch), in which I found beautiful specimens of *Millepora alcicornis*, *Siderastræa*, *Favia*, etc., together with two or three species of gorgonias, belonging to the genera *Hymenogorgia*, *Plexaurella* and *Eunicia*.

Turning over the loose corals in the pond, I found a host of interesting things, sea-urchins (*Echinometra Michelini*), crimson starfishes (*Echinaster crassispina* Verrill), together with many odd crabs. There is a curious little crustacean, of which there appears to be more than one species on the coast of Brazil, called the *Tamarú*. I used to be much puzzled when walking near muddy shores when the tide was down, by hearing a sharp clicking sound. The *Tamarús* are the musicians. I suppose the sound to be made in some way by the claws. These *Tamarús* are very abundant, living in the holes in the reefs, and I have more than once, when sailing over a reef, heard their musical click in the water underneath me. There is a whole group of shrimp-like crustaceans, whose hind-body is unprotected by a shell, and which are called hermit-crabs, from their taking up their abode in dead shells. I found one large hermit-crab on this reef, which was occupying a rather large shell on which was seated a sea-anemone. It is a strange companionship which has been observed to exist between other species elsewhere. The reef is not very rich in shells.

One of the men threw the round net successfully over some charming little fishes in the ponds, and we soon had a

large collection of things, which we carried to the edge of the reef. The tide by this time had gone down farther, and the water was low enough on the border of the reef to allow one to wade all over and examine it. The very edge of the reef where the waves washed at low tide is higher than elsewhere, partially owing to a better opportunity being offered for the growth of corals, but also to a luxuriant growth of serpulæ, barnacles, etc. From this line the reef slopes gently down to the edge,* where it drops down perpendicularly into deep water, as at the islands. This border, where the water was of little depth, and where the bottom was never exposed at low tide, may be at times very narrow, or even a hundred feet or more in width. It is a perfect garden of corals. Do you wonder, my reader, that the writer felt a little bit excited as he waded about, up to his waist in water, over these coral beds?

The whole reef is alive. Here is a big head of *Acanthastrœa Braziliensis* Verrill. We must have that, so down we bend to tear it away from the reef. A wave goes over our head, but what of that? the prize is secured. We tug away to tear up the fronds of the gorgonias, and toss them over the edge of the reef into a pool of water. Now we fill our arms, never so carefully, with pretty pink rosettes of *Millepora nitida* Verrill, which we are careful about handling, because of their stinging properties. These are safely lodged on the reef, and we wade out once more to the very edge of the reef (never mind the sharks!). Here are beautiful clusters of the pretty *Mussa*, with which Professor Verrill has done the writer the honor of associating his name, that look like great bouquets of whitish pinks. What a pity that we cannot pluck them whole, for they break up and go all to pieces, while the polyps out of water lose all their beauty!

But I shall make this paper too long, if I stop to enumerate all the beautiful things of this garden of the sea; the

* This submerged border is seen in the sketch.

tide is coming in, and we must be in haste. We have yet time, however, for a short walk over the reef.

The tide creeps over the reef. Our specimens are transferred to the deck of the launch, and we put out of our little harbor, with a sigh that our exploration in the Abrolhos waters are ended.

The depth alongside the reef at low water varies much, being in some places but three or four, in others ten feet or more. Just alongside the reef, at least on the inside wherever I have examined it, the bottom consists of a soft, bluish, calcareous mud. The bottom usually slopes rapidly from the reef, and one may at a short distance away in some places find a depth of seventy to eighty feet. Generally the reef is bordered by Chapeirões.

Similar reefs are found a few miles farther south at Coróa Vermelha and the vicinity, but I know of none still farther southward. To the north they occur at intervals with the same characters at Itacolumis, Porto Seguro, Santa Cruz, Bahia, Maceió, and along the coast in the vicinity of Pernambuco and northward. The Rocas, a very dangerous reef lying in the latitude of Fernando de Noronha is a coral reef, and is remarkable for its annular shape, inclosing a space in the centre free from corals.

From the descriptions of the sailors, Corôa Vermelha is a coral island. The only other of any note I have seen is at the mouth of the bay of Santa Cruz. I saw a few mangrove trees growing upon it. A schooner had struck on the reef near by, and being carried over by the waves, had sunk close inside the reef. From the height to which the water reached on the mast, I estimated the height of the reef at thirty feet.

Fortunately we had a pleasant trip home, and late in the afternoon the launch was anchored off the melting-house of the Barra. A few cornet notes brought out some of the inhabitants to welcome the incomprehensible *Naturalista*, who, landing, spent the rest of daylight in examining the

carcasses of some huge whales brought in to land since his departure.

The moon rose full and round, but waned rapidly as she neared the zenith. A fine eclipse took place which was almost total. Crowds gathered on the shore to watch the moon's fading light. The *Americano* ought to be able to explain it. He is applied to. Whereupon, by the light of an antique oil-lamp in a store near by, with a big earthen water-jar to personate the earth, and a smaller one the moon, a lecture on the theory of eclipses was delivered to an appreciative audience, with heaven's blue dome for a chart.

Next day a few hundred weight of whales' bones were added to our freight, and we moved up stream. The tiled roofs and white walls and cocoa palms of Caravellas came in view, Jaco blew his horn, and, in a few moments, with the rattle of the chain from the bow, the Cruise of the "Abrolhos" had ended.

NOBERT'S TEST PLATE AND MODERN MICROSCOPES.

BY CHARLES STODDER.

Every possessor of a first-class microscope wishes to know what his instrument is capable of doing. To the practical worker it is a matter of much importance, for when the utmost power of his instrument is exhausted, he will know that it is a waste of time to endeavor to see more. One of the desirable and important properties of a microscope is the power to show or "resolve" very fine lines grouped together, e. g. the striation of the frustules* of the diatomaceæ. For the purpose of testing the resolving power of the microscope, the lines ruled on glass by F. A. Nobert, of Barth,

*A frustule (*L. frustrum*, a fragment) is one of the fragments into which diatoms separate.

Pomerania, have long been admitted by experts as the best known test, not only in consequence of their exceeding fineness, but also because they are ruled to a known scale, and because they are so close that physicists have asserted that it is impossible that they ever can be seen, Nobert himself being in this category; and all trials of these plates, except those to be herein mentioned, have resulted in failures to resolve the finer lines of these plates.

The Nobert test is a series of groups of parallel lines ruled on glass thus ||||| |||||, each succeeding group being finer than the preceding one. Different plates have a different number of groups, ruled to different scales. The one used by Messrs. Sullivant and Wormly (American Journal of Science, 1861) has thirty bands or groups, the coarsest having its lines $\frac{1}{1000}$ of a Paris line apart, and the finest being $\frac{1}{3000}$; each group or band being about $\frac{1}{2000}$ of an English inch in width, and the whole thirty occupying a space perhaps a little more than $\frac{1}{50}$ of an inch. Now it is a difficult matter for the mind to appreciate such minute divisions of space, yet it is essential, in order to estimate a little the difficulty of seeing such lines, to form some idea of their minuteness. The average diameter of a human hair is about $\frac{1}{1000}$ of an inch, yet in a space only one half as great in the coarsest band of the Nobert plate there are seven lines, while in the 30th band there are forty-five.

The plate which I have used in the trials to be detailed was made in 1863. It has nineteen bands, the first being ruled to $\frac{1}{1000}$ of a Paris line, and each band increasing by five hundred, so that the 19th is $\frac{1}{10000}$.

The following table gives in the second column the fractional part of a Paris line* between the lines of each band: the third column, the decimal part of a line as marked on the plate by Nobert; the fourth, the number of lines to an English inch; the fifth, the number of the band in a thirty-band plate corresponding in fineness.

* One Paris line = .088815 of the English inch.

	Paris line.	Decimal of Paris line.	Lines to English inch.	Corresponding No. of Sullivant and Wormly's plate.
1.	1-1000	.1001	11,240	1st
2.	1-1500	.000633		
3.	1-2000	.0005	22,480	
4.	1-2500	.0004		
5.	1-3000	.000333		
6.	1-3500			
7.	1-4000	.00025	44,960	
8.	1-4500			
9.	1-5000	.0002	56,200	15th
10.	1-5500			
11.	1-6000	.000167	67,622	20th
12.	1-6500			
13.	1-7000	.000143	78,737	25th
14.	1-7500		84,400	
15.	1-8000	.000125	90,074	30th
16.	1-8500	.000117	96,234	
17.	1-9000	.000111	101,434	
18.	1-9500	.000105	107,167	
19.	1-10000	.000100	112,668	

Has human art ever made an instrument capable of rendering lines, 112,000 to an inch, visible? If not, is it possible to do so? Is there anything in the laws of light, which renders it impossible to see lines so close, and therefore render useless the labors of the optician to improve his instruments beyond a certain point? and, as a corollary, is it decided that it will be useless for the naturalist to try to investigate the structure of tissues beyond what the best existing instruments have shown? It must be borne in mind that the power of seeing a single object is not the question, but the power of distinguishing two or more objects nearly in contact. The problem is exactly the parallel of that of the power of the telescope of separating double stars. A brief sketch of what has been done, and what opinions on the problem have been expressed by eminent microscopists and opticians is essential to a full understanding of the question.

Professor Quecket, in 1855, asserted that "no achromatic has yet been made capable of separating lines closer together than the $\frac{1}{75000}$ of an inch." "Mr. Ross found it impossible to ascertain the position of a line nearer than $\frac{1}{80000}$ of an inch." "Mr. De la Rue was unable to resolve any lines on Nobert's test plate closer than $\frac{1}{81000}$ of an inch."

Dr. William B. Carpenter, in his work on the Microscope, published in 1856, says, "Even the $\frac{1}{12}$ objective will probably not enable any band to be distinctly resolved, whose lines are closer than $\frac{1}{79000}$ of an inch. At present, therefore, the existence of lines finer than this is a matter of faith rather than of sight; but there can be no reasonable doubt that the lines do exist, and the resolution of them would evince the extraordinary superiority of any objective, or of any system of illumination which should enable them to be distinguished." In his second edition issued in 1859, Dr. Carpenter repeated the same remarks, but substituted $\frac{1}{85000}$ for $\frac{1}{79000}$, and then added, "There is good reason to believe that the limit of perfection (in the objective) has now been nearly reached, since everything which seems theoretically possible has been actually accomplished." In the third edition, 1862, he again alters the figures to $\frac{1}{84000}$, but adds nothing more.

On the other side the late Professor J. W. Bailey claimed to have seen lines as close together as $\frac{1}{100000}$ to the inch, and Messrs. Harrison and Solitt, of Hull, England, claimed to have measured lines on the diatom *Amphipleura pellucida*, as fine as 120,000 to 130,000 to the inch, and expressed the opinion that lines as fine as 175,000 might be seen with proper means.

To determine if possible the truth between these conflicting opinions, Messrs. Sullivant and Wormley (American Journal of Science, January, 1861) made an exhaustive trial of one of these "marvels of art." They state that the optical apparatus at their command was ample; it included a "Tolles' $\frac{1}{50}$ objective of 160° angular aperture,—an objective of rare excellence in all respects,—besides $\frac{1}{12}$ and $\frac{1}{16}$ objectives of other eminent opticians." They were able to obtain an amplification of 6,000 diameters. The plate contained thirty bands, as previously mentioned.

"Up to the 26th band ($\frac{1}{78100}$) there was no serious difficulty in resolving and ascertaining the position of the lines; but on this and the

subsequent ones, spectral lines, that is, lines composed of two or more real lines, more or less prevailed, showing that the resolving power of the objective was approaching its limit. By a suitable arrangement, however, of the illumination, these spurious lines were separated into the ultimate ones on the whole of the 26th, and very nearly on the whole of the 27th band ($\frac{1}{81213}$); but on the 28th, and still more on the 29th, they so prevailed, that at no one focal adjustment could more than a portion of the width of these bands be resolved into the true lines. The true lines of the 30th band we were unable to see, at least with any degree of certainty."

"These experiments induce us to believe that the limit of the resolvability of lines, in the present state of the objective, is wellnigh established," and they draw the conclusion, "that lines on the Nobert's test plate, closer together than about $\frac{1}{78000}$ of an inch, cannot be separated by the modern objective."

Although the paper of Messrs. Sullivant and Wormley was republished in the Quarterly Journal of Microscopical Science, in London, and might be considered as being a challenge to the opticians and microscopists of Europe to show what they could do in resolving the test plate, yet no report can be found of any attempts to resolve the lines until 1865, when Max Schultz (Quarterly Journal of Microscopical Society, January, 1866) described the Nobert plate of nineteen bands, and gave the results of his trials for resolving them. "The highest set he has been able to define with *central* illumination is the 9th, which is resolved with Hartnack's immersion No. 10, and Merz's immersion system $\frac{1}{24}$. With *oblique* illumination he has not been able with any combination to get beyond the 15th." It will be seen by reference to the table that Schultz saw finer lines than Sullivant and Wormley. This is the only report we can find in print from Europe.

In this country we find no published results; but Mr. R. C. Greenleaf, of Boston, and the writer were well satisfied that they saw the lines 90,000 to the inch with a Tolles' $\frac{1}{8}$ in 1863, and the next year Mr. Greenleaf saw the same lines, unmistakably, with a Tolles' $\frac{1}{12}$. Dr. J. J. Woodward, of Washington, in a communication to the Quarterly Journal of Microscopical Science, London, October, 1867, p.

253, states that with monochromatic light, and Powell and Lealand's $\frac{1}{50}$, $\frac{1}{25}$, and $\frac{1}{16}$ objectives, a Hartnack immersion, No. 11, and a Wales $\frac{1}{8}$, with amplifier, he satisfactorily resolved the 29th and 30th bands of Nobert's test plate. In a letter to the writer written since, Dr. Woodward informs me that the plate used was the *same one* used by Sullivant and Wormley, as the 30th band was the finest on that; the result did not show that finer lines could not be seen. Dr. Woodward informs me, that, since writing that paper, he has received a Nobert plate with the nineteen bands, and that the covering glass was too thick for the $\frac{1}{50}$ objective, but with all the others he was able to resolve the 17th band (101,000 to the inch); the 18th and 19th he was unable to resolve. Dr. Woodward has sent to me a photograph of the 16th, 17th, 18th, and 19th bands, taken by Dr. Curtis with the Powell and Leland $\frac{1}{25}$. In the photograph, the lines of the 16th and 17th bands may be counted with some difficulty, but if the whole band is copied, or if the bands are of the width of $\frac{1}{2000}$ of an inch, there are not lines enough. The lines of the 18th and 19th bands cannot be counted in the photograph. From this it will be noticed that Dr. Woodward has resolved *finer lines* than any other observer had yet seen, so far as report gives us any information.

My esteemed correspondent, M. Th. Eulenstien, of Stutgard, Wirtemberg, writes to me, under date of Dec. 17th, 1867, "I have myself resolved the 14th band with a $\frac{1}{12}$ Powell and Lealand, and also, but less unmistakably, with No. 11 Hartnack's immersion, with oblique light." "Nobert himself has never seen with his highest powers higher than the 14th." "This will show you the continental state of affairs." Mr. R. C. Greenleaf and myself have lately tried several objectives, and the result is appended below:*

*Wales' 1-5 ang. ap., 140°, B eye-piece, power 475 dia., sunlight oblique, . .	8th band.
Hartnack's immersion No. 10 = 1-14, ang. ap. 155°, power 1062, B eye-piece, light oblique, ...	10th "
Nachet's immersion No. 6 = 1-12, B eye-piece, sunlight oblique, ...	8th "
" " No. 10 = 1-21, B eye-piece, sunlight central, ...	9th "

With Tolles' $\frac{1}{6}$ immersion, angular aperture 170°, B eye-piece, power 550, Mr. Greenleaf and myself both saw the 19th band satisfactorily. Thus being probably the first ever to see lines of 112,000 to the inch, and establishing the fact of the visibility of such lines, contrary to the theory of the physicists. (It should, however, have been mentioned in the proper place that Mr. Eulenstien says that Nachet claims to have seen them by sunlight recently, which claim needs some confirmation, as his No. 10 failed so completely in my hands.

In the present month (January, 1868), Dr. F. A. P. Barnard writes to Mr. Greenleaf, that he had tried several objectives, naming a Spencer $\frac{1}{20}$ and $\frac{1}{12}$, a Tolles' $\frac{1}{10}$ and $\frac{1}{3}$, a Wales $\frac{1}{4}$, and a Nachet immersion No. 8, equal to a $\frac{1}{15}$. "The Spencer $\frac{1}{20}$, and the Natchet $\frac{1}{15}$ broke down at about the 11th or 12th band. With the Wales $\frac{1}{4}$ I got as far as ten, or perhaps eleven bands. With the Tolles' $\frac{1}{3}$ I made out distinctly ten."

In another communication he says, "the highest band I can count is the 16th." In a more recent letter to the writer, Dr. Barnard gives the count of the lines on a portion of his plate,—corresponding as nearly as could be expected to figures given in the table up to the 14th; but the 16th band he could not count satisfactorily, different attempts giving varying results. It has been said that the resolution of the lines to the eye implies the ability to count them, but this I think is a fallacy; a few lines of a group may be counted correctly, and then it becomes difficult to identify the line last counted and the one to be counted next. Let any one try to count the pickets in a fence, when the pickets are distinctly visible, say at a distance of 100, or 150 yards,

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Nachet's immersion No. 10 = 1-21, B eye-piece, sunlight oblique, ... 12th band.
Tolles' immersion 1-10, ang. ap. about 160°, B eye-piece, power about 800, sunlight central, ... 8th "
Tolles' immersion 1-10, ang. ap. about 160°, B eye-piece, power about 800, sunlight oblique, ... 12th "
Tolles' immersion 1-10, ang. ap. about 160°, B eye-piece, Petroleum, light oblique, ... 13th "
Tolles' immersion 1-10, on another occasion I saw the . . . . 15th "

he will find this difficulty almost insurmountable. In the microscope the micrometer is an aid in counting, but in counting lines of such exquisite fineness, either the micrometer or the stage must be moved, and it is next to impossible to construct apparatus that can be moved at once $\frac{1}{100000}$ of an inch and no more. It would require the genius and skill of Nobert himself to do it.

These trials show conclusively, that it is not the great power of the objective that is important (for in many of the trials here reported the lower powers have given the best results, and the Tolles' $\frac{1}{6}$ immersion the best on record), but it is the skill of the optician in making the instrument. I have since tried the Wales' objective *dry*, and resolved the 13th band well,—thus doing what Mr. G. did with it in water; the inference must be that Mr. G. did not obtain its best work.

NOTE.—Since the foregoing was written, Dr. Barnard has made more trials, and I am well satisfied that he has seen the 19th band with a Spencer $\frac{1}{12}$ and Tolles' $\frac{1}{5}$, *both dry objectives.* This performance fairly surpasses any thing yet done, either in this country or Europe. Dr. Barnard writes (Jan. 29), that he found that the counting of the lines was attended with the very difficulties referred to above, in addition to which there is another trouble, the whole width of a band is not in perfect focus at once; this necessitates a slight change of focal adjustment, and any change renders it extremely difficult to fix, even with the cobweb micrometer, the exact line last counted. He made five counts of the 19th band with the $\frac{1}{12}$, namely:—

1.	110,392 to the English inch.	4.	106.226 to the English inch.
2.	108,270 " "	5.	115,474 " "
3.	113,737 " "		mean, 110,820 " "

The number, according to Nobert, is 112.668. He counts for the 15th 91,545, Nobert, 90,074. Though there is apparently considerable discrepancy between the count and Nobert's figures, yet I consider it as near as can be reasonably expected when all the difficulties are appreciated. Besides, it must be remembered that Dr. Barnard gives as above the number of lines to an inch, not the number actually counted. The actual number in the 19th band should be 56.5, if the band is *exactly* $\frac{1}{2000}$ of an inch, a variation of two lines each way covers the extremes of his counting.

Mr. Greenleaf has just tried (February 7th) an immersion objective by Wales' $\frac{1}{15}$. He resolved the 10th, 11th, and 12th bands perfectly; the 13th

was doubtful. Another trial of the Hartnack No. 10 resolved the 13th band perfectly,—the 14th doubtfully.

English and American opticians name their objectives (*i. e.*, the lens or lenses placed next the object, that next the eye being the eye-piece), from their magnifying power,—thus a ¼ inch objective has the same power as a simple lens of ¼ inch focus. Continental European makers generally distinguish their instruments by numbers; the higher numbers indicating higher powers; but as each maker has his own system, the actual power of an instrument must be ascertained by trial. Instruments also often differ from their names, and they cannot generally be depended on. The theoretical power of a microscope is measured from an arbitrary standard of ten inches,—thus, a one inch is said to magnify ten diameters; a ¼ inch, forty diameters. If the standard is taken at five inches, as it is by some, then the "power" is but one half as much. The "power" of the *microscope* is that of the objective multiplied by that of the eye-piece; if the objective magnifies ten diameters, and the eye-piece ten, the result is one hundred diameters.

Angular aperture is the angle in the surface of the front lens, at which light will enter the objective,—the greater the angular aperture, the more light, and usually the greater *resolving* power.

An *amplifier* is an achromatic combination inserted in the compound body of the instrument to increase the "power" of the objective and eye-piece.

Immersion lenses have lately attracted great attention, though they were made by Amici many years since. The objective is immersed in water,—that is, there is a film of water between the front of the objective and the object, or the thin glass covering it. The effect is a great increase of light, and better definition.

REVIEWS.

THE ANIMAL NATURE OF SPONGES.*—Many opinions have been expressed with regard to the animal nature of the sponge, which has been considered as a plant by most authors, but nothing of a reliable or definite nature had appeared before a paper by Mr. Carter in the Annals and Magazine of Natural History, for April, 1857. In this paper it was first shown that the organized layer of the sponge was made up of single-

*On the Spongiæ Ciliatæ as Infusoria Flagellata; or, Observations on the Structure, Animality, and Relationship of *Leucosolenia botryoides* Bowerbank. With two plates, and more than seventy-eight figures. By Professor H. James Clark, A. B., B. S. Memoirs of Boston Society of Natural History, June 20, 1866.

ciliated cells, which were supposed to be allied to Amœba, an animalcule, because they were seen to take in food apparently through the walls of the body, and not through any proper mouth. Professor Clark shows that *Leucosolenia botryoides* Bowerb. is an aggregation of new forms of Monads closely allied to *Monas termo* Ehren. The existence of a mouth at the base of the flagellum, a lash-like organ present in many infusoria, is demonstrated in all these forms, and all except Monas are described as possessing a hyaline calyx, or cup, surrounding the region of the mouth, like an inverted funnel. The single monads which compose the ciliated layer lining the internal channels of *Leucosolenia*, a common marine sponge, have a similar calyx, are monoflagellate (that is, provided with a single lash-like appendage), and probably have a mouth at the base of the flagellum, since they took in their food in the same manner as the *Monas termo*. The connection between Monas and its allied forms, with the higher Protozoa, or infusoria, such as Euglena, Dysteria, and Pleuronema, is shown by *Anthophysa Mulleri* which has two flagella, like the higher forms mentioned, but like Monas has no calyx, and grows in umbellate colonies like Codosiga. The direct relation anatomically and zoölogically of the sponge with these exceedingly active and beautiful forms is startling, and one sees in the great advance in the study of the Protozoa made by Professor Clark, that, after all, Ehrenberg's belief that these minute forms had a very highly complicated organization, is, like most opinions, not without a kernel of truth. — A. H.

The Progress of Zoölogy in 1866.* — Another volume of this invaluable year-book, which is simply indispensable to the working naturalist, has just been published. We hope it will meet with much encouragement among American zoölogists. In the words of the chief editor, "The object of the Record is to give, in an annual volume, reports on, abstracts of, and an index to, the various zoölogical publications which have appeared in the preceding year; to acquaint zoölogists with the progress of every branch of their science in all parts of the globe; and to form a repertory which will retain its value for the student of future years."

The scientific part of the zoölogical literature of 1864, to which vol. 1 forms a guide, amounts to more than 25,000 pages; that for 1865 amounts to not less than 35,000 pages; and that for 1866 to about 30,000 pages. In the literature for 1865, it is estimated that about 7,000 animals are described as new to science.

In running through the 649 pages of the last volume we glean the following items of interest. — Professor Lilljeborg states in his memoir on the Rodents that about 2,300 species of Mammalia are known, namely, about 700 *Rodents*, 500 *Chiroptera* (Bats), 250 *Feræ* (including Insect-

* The Record of Zoological Literature. Edited by A. C. L. G. Gunther, M. D., 1864–'66. London, 1865–'67, 8vo, vol. 1, pp. 634; vol. 2, pp. 784; vol. 3, pp. 649. The Mammalia, Reptiles, and Fishes are reported on by Dr. Gunther; the Birds by Alfred Newton; the Insects by W. S. Dallas; the Crustacea by C. Spence Bate; the Worms, Radiates, and Molluscoida (Tunicates and Polyzoa), by E. Percival Wright; and the Mollusca by E. von Martens. The price of each volume is about $6.00 in gold. We shall be pleased to take orders for our subscribers.

ivora), 200 *Quadrumana* (Monkies), and about as many *Artiodactyla*.* — A. Müller proves that the male fox lives in polygamy, and does not assist in rearing his offspring. — A young Hippopotamus has been successfully reared in the Zoölogical Gardens in Amsterdam. — Mr. G. O. Sars refers to the contradictory statements of naturalists with regard to the ejection of water from the blow-holes of whales. He states that if the head with the blow-hole is raised above the surface of the water, nothing but air is expelled; but if, at the moment of expiration, the head is still below the surface of the water, the force of the air expelled carries a portion of the water with it, causing a more or less perceptible spray. — In ornithology, the most important fact elicited during the year is the discovery of the bones of the Dodo by Mr. Clark, chronicled on p. 614, vol. 1, of the NATURALIST. — In a work on the fossil birds of France, A. Milne-Edwards reports that all the fossil birds of the tertiary epoch can be included in the natural groups which still exist, though none of the species are identical with the living forms, and some are types of new genera. Of the quaternary period twenty-three species have been determined, only one of which, a very large *Grus*, is extinct, though as regards France, two species, *Lagopus albus*, the White Ptarmigan, and *Nyctea nivea*, the Snowy owl, both inhabitants of the arctic regions, no longer exist there, being relics of the Glacial period. — The Great Auk is supposed to have occurred of late years on the Norwegian coast, and it is supposed to have bred on Lundy Island (coast of Devonshire), in 1838 or 1839. — A commission of Dutch naturalists have reported on the Ship-worm, *Teredo*, and the means of combating its attacks. It bores into solid wood by the mechanical rasping action of the minute denticulations covering a part of the surface of its valves, the movements having been seen by M. Kater on a living animal. It has an enemy in a worm, *Lycoris fucata* Haan, which feeds upon it. As regards means of protection the commission report: —

1. It is of no use to coat the surface of the wood with any substance supposed to be impenetrable to the Teredo, as this coating will be damaged sooner or later.

2. The impregnation of the wood with soluble inorganic salts, does not prevent the animal from invading the wood.

3. The hardness of the wood itself does not offer any protection, the wood of the "gaiac" and the "mamberklak" being invaded.

4. The only means offering a high probability of protection against the animals is the impregnation of the wood with creosote. — M. Alphonse Milne-Edwards says of *Lysianassa* (Eurytenes) *magellanica* that he has compared a specimen from Spitzbergen with one in the Paris Museum, "taken from a fish's stomach near the Straits of Magellan. These two individuals seem to resemble each other very closely (*beaucoup*), and I

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* Professor Owen divides the hoofed, or ungulated mammals, into *Perissodactyla* (those with an odd number of toes), and the *Artiodactyla* (including most of the ruminants), which consist of those with an even number of toes.

have only seen a difference between them of size." — The occurrence of a venomous black spider is noticed at Berdiansk, amongst the wheat at harvest time. — Guyon writes on the parasitic Flea, or Chigoe. *Pulex* (Rhynchoprion) *penetrans*, which lives under the skin of man and pigs. Among its natural enemies is the Cockroach (*Blatta Americana*). The False Scorpion (*Chelifer cancroides*) is destructive to the common Flea.—Donné gives an account of some experiments conducted for the purpose of determining the possibility of spontaneous generation (heterogeny). Pasteur replies to these observations of Donné's, stating that his experiments are not free from many sources of error, and pronounces it as his fixed opinion, that, in the actual state of science, heterogeny is a chimæra.

NATURAL HISTORY MISCELLANY.

BOTANY.

Can Lichens be identified by Chemical Tests? — Some interesting experiments illustrating the differences in the chemical constitution of Lichens have lately been published (Regensburg Flora, 1866; translated by Rev. W. A. Leighton, in the Journal of the Linnæan Society of the same year) by Dr. Nylander, of Paris; and his observations have been followed by an extended application of one of the tests proposed to the large genus *Cladonia*, by Mr. Leighton (Annals and Magazine of Natural History, 1866), and by a general consideration of the described phenomena as recognizable in Spitzbergen species, by Dr. Theodore Fries (Lichens of Spitzbergen in Acta Holmiæ, 1867).

It appears, from these experiments, that Hypochlorite (Chloride) of lime furnishes "a sort of immediate analysis" of the colorable matter in *Roccella* (Archill of dyers) when applied, in solution, to the fronds; and the species which do not furnish this matter and fail therefore to exhibit the "erythrinic" reaction, or the presence of erythric acid (the case with our solitary, North American form) are of course in such way distinguishable from those which do. The same holds good in *Dirina*; in *Lecanora tartarea* (Cudbear of dyers) as compared with closely allied species, and in *Umbilicaria* and *Parmelia*, it being necessary in the latter that the inner, or medullary layer should be submitted to the test.

In like manner Hydrate of Potash is shown to effect several different reactions, according as the tissues subjected to it differ chemically. In most yellow *Parmeliei* (*Theloschistes*) and *Lecanorei* (*Placodium*) as in the red fruit of species of *Cladonia* and of *Biatora*, in *Heterothecium Domingense*, etc., the contact of the salt immediately induces a purplish tinge (supposed to indicate what has been called chrysophanic acid) and the species otherwise referable to the groups named which do not show this change (as *Theloschistes candelarius*) are thus elegantly, and sometimes

most conveniently, separable. So again, in many other Lichens (supposed now to contain usneic acid) as *Parmelia* and *Lecanora*, *Cladonia*, etc., the reaction, if it occur, is yellow, or greenish-yellow, and serves to separate, in this way, otherwise closely related forms. It is with the botanical value of these forms, sometimes so close that they were not before taken to differ even as varieties, but now assumed, and, in part at least, on no other than the kind of evidence above given, to be "species," that botanists are concerned.

I have gone through a large part of my North American and exotic Lichens in the light afforded by these experiments, and found the facts, if sometimes suggestive of more than is stated, generally clear; much clearer than the value attributed to them. Is it not indeed safe to say at once that species are not determinable, in Botany, by such tests? Dr. Fries has well pointed out the curious and significant parallelism running through *Cladonia*, wherein forms, agreeing in almost every other respect, are seen to differ, and in the same way, in their behaviour with potash; and his list of such forms might yet be extended. *C. delicata*, of the first series below, is complemented, it appears (Leighton's Cladoniæ, p. 6) by a *C. subdelicata*; and *C. athelia* bears, with little doubt, a similar relation to *C. Santensis*. Nor does there appear to be reason for estimating the value of the terms of these parallel series, as, for example,

Not tinged by Potash.	Tinged yellow by Potash.
Cladonia gracilis, ...	"*Cladonia ecmocyna*,"
Cladonia degeneranis, . . .	"*Cladonia lepidota*,"
"*Cladonia subdelicata*," . .	*Cladonia delicata*,
"*Cladonia bacillaris*," . . .	*Cladonia macilenta*,

and so on, any higher or otherwise than in *C. furcata*; wherein we are told (Leighton's Cladoniæ, p. 9) Dr. Nylander does not consider the chemical difference which he regards as sufficient to separate "*C. ecmocyna*" from *C. gracilis* as indicating anything more than "only a distinct variety." Indeed it is difficult to see why *genera* (as for instance in the groups mostly characterized by a yellow thallus and polar-bilocular spores) should not be as properly determinable by these reagents, and nothing else, as species.

The observations cited are, however, plainly incomplete; and derive from this perhaps not a little of their interest. *Parmelia perlata* is thus said to differ specifically from its var. *olivetorum* Ach., by failing to show any red tinge with Chloride of Lime; the difference already recognized being regarded as sufficiently corroborated by the new one. But *all* specimens of *P. olivetorum* are not so distinguishable, as compare the excellent ones in Welwitsch's Portuguese collection, No. 75, and Massalongo's Italian, No. 325; and the assumed organic diversity thus failing, there is left only the (in itself uncertain) merely chemical one. It is much the same with *P. lævigata* and its variety *revoluta* Nyl. (Synopsis, p. 385), the last being now taken, and on the same evidence, to be distinct in species from the first. We have here a better marked difference in botanical character,

one which commended itself as sufficient to Floerke, and, at one time, to Borrer; and there seems to be no doubt that this original *P. revoluta* Floerk.! is discrepant from common states of *P. lævigata* in the chemical respect also. Yet this will not hold of the similar American lichen referred to the same variety, at the place cited, by Nylander, which shows no reaction; while, on the other hand, an European condition (Herbarium Krempelh.) is not wanting, associable far less with *revoluta* than with *lævigata*, the evident reaction in which favors the inference that the latter varies possibly in its chemical relations as much as the former; and that the new criterion is after all of no service. In all my numerous European specimens of *P. tiliacea*, the medullary layer is tinged red by the same salt, as stated by Nylander; but only two or three of the much more abundant North American ones show any trace of the reaction: the same discrepancy recurring in the intertropical forms, instanced by the var. *sublævigata* Nyl. (Lindig's Herbarium of New Granada), of which No. 110 of the second collection exhibits the coloration, while No. 736 fails to. Some of the specimens from this continent, showing no change of color, might indeed be referred or rejected to the conterminous *P. lævigata;* but surely not all: and it is safer to infer that the species before us furnishes only another example of the variableness of Lichen-groups in this respect. *P. caperata* is reckoned, by the same authority, among the species the medullary layer of which gives no indication of a red tinge with the reagent. I find yet the contrary the case in North American specimens, as well from Arctic America as from Texas; in Chilian and Peruvian ones; and in one said to be from Spitzbergen (Hookerian Herbarium), almost all these states being also marked by elevated, powdery margins,—as if a var. *ulophylla* (see Acharius) filled in this species an analogous place to the var. *olivetorum* in *P. perlata*, —but some (it is worthy of note) sufficiently normal. *P. Borreri* belongs, it is further said, to the number of species which exhibit the reaction; but none is observable in several well-marked North American specimens in my herbarium, and the same is true of the New Grenada *P. Borreri* Nyl. (Lindig's Herbarium, No. 735). The group represented by *P. physodes* is, on the other hand, set down as not affected by the salt in the way named. *P. Japonica*, of the present writer, belongs none the less to the group, and exhibits a free coloration. So *Dirina* is reckoned generally as displaying "a very distinct erythrinic reaction;" yet the Californian species (*D. Californica*) fails to respond to the test. A pale yellow tinge follows the application to the last-named Lichen, as in many other cases; but in what appears rather a corticoline form of *P. conspersa*, from Louisiana (var. *leucochlora* Nyl.), the change is to bright yellow not without orange, contrasting with the entire want of coloration in common states, and perhaps therefore not unworthy of note in the present discussion.

These results, given with due respect to the experienced authors whose observations have been considered, sufficiently indicate that the writer

inclines to emphasize the doubts with which Dr. Fries has received the supposed new criteria of distinction. It remains none the less likely, from what evidence we have, that the reagents named, capable as they are of instructive application to imperfect fragments of specimens, may sometimes afford clews to affinity where there is little to direct; and thus deserve a place beside the better-known solution of iodine, on our working tables.—E. TUCKERMAN, *Amherst.*

THE SUN-DEW A FLY-TRAP.—I wish to call the attention of botanists to a very humble little plant, the *Drosera rotundifolia*, or common sun-dew, which not only catches flies, but eats them. I was looking early in the spring in a swamp for chrysalids, when I noticed the tiny leaves of the sun-dew, which has beautiful blood-red glandular hairs, each tipped with a glistening dew-drop. The leaves were covered with the wings and legs of gnats. One or two had the hairs gathered into a knot at their centres, and on one a live gnat was struggling hopelessly to escape. I secured two plants and kept them for several weeks by laying the bit of moss on which they grew in a plate supplied every day with water. During this time I fed them with midges, ants, and beefsteak. The tiny drop of dew is glutinous, and any small insect touching them is lost. Every effort to escape but hurries its doom, and in a moment wings and legs are held fast to the tiny bristles.

Now begins the curious part of the affair. All the hairs begin to move towards the insect, but so slowly that their motion is almost imperceptible. In a few hours the hairs touch and cover it with their adhesive points. I placed a piece of raw beefsteak on the centre of a leaf. In twelve hours nearly every hair touched it. They gathered over it in knots and remained so for a day and a half, when they slowly returned to their natural position, leaving the beef a white sodden atom resting on the points of the hairs. I tried it with a bit of paper, but it refused to move for that; then a tiny fly was touched to one of the treacherous dew-drops, smothered, and in a few hours all the ferocious little scarlet hairs had their beaded points upon his body. When the *blossom* bud appeared, the glands no longer secreted the dew, and the leaves lost their brilliant color.—L. A. MILLINGTON.

TWO CROPS OF ROSES.—Another correspondent has mentioned a monstrosity in roses. I have a Provence rose which for three years in succession has borne numbers of flowers after its usual time of blooming. The late roses generally grow directly out of the old one until the third is produced. Some of them are perfect with the exception of the calyx, which is undeveloped; while others are a confused cluster of pink leaves, at the end of a stout stem.—L. A. M.

A WHITE WILD COLUMBINE.—One of your correspondents has spoken of finding Columbines that were nearly white. I believe they are not uncommon, as I have frequently found not only Columbines but *Lobelia cardinalis* of a delicate white or cream color.—L. A. M.

ZOÖLOGY.

ARE BEES INJURIOUS TO FRUIT? — Dr. H. A. Hagen, late of Königsburg, Prussia, who is an eminent entomologist, and who has paid special attention to the literature of Bees and Bee-keeping, thus writes us regarding this question: —

"I have never known, and find nothing in the literature now at hand to prove that Bees are obnoxious to fruits and to fields. Bees can never use the fields of *red* clover; the corolla is too long for their proboscis. But they are very frequently seen in the fields of white clover, and I have heard that these fields are obnoxious to bees, if shortly before rain has fallen."

APIPHOBIA. — The people of Wenham have voted, by a two-thirds majority, that no bees shall be kept in the town — the vote being directed against an extensive bee-keeper whose stock has been troublesome. Some say the action of the town is of "doubtful constitutionality." — *Boston Journal.*

The good people of Wenham have judged that bee-keeping and fruit-raising are incompatible, and that bees are a nuisance!! We also notice that the bee-keeper "whose stock has been troublesome" advertises in the *Salem Gazette*, his farm for sale, consisting of "three-quarters of an acre of tillage land, containing from seventy-five to one hundred pear trees, besides apple trees. The pear trees, 1867, bore thirty bushels of choice standard fruit." (*Memorandum.* — The bee-keeper himself seems, from the above quotations, to have found *both* fruit-raising and bee-keeping a source of profit!!)

Have we gone back to the Dark Ages, the age of belief in Dragons, "Gorgons and Chimæras dire," Krakens, Unicorns, and Witches and Witchcraft? Are these poor bees to be voted worse than fiends and dragons, about which there is always a sort of tragic interest, and to be adjudged only as "common nuisances," to be abated and extinguished by the ballots of Wenham's "free and independent woters?" This disease, *Apiphobia*, as we may call it, has afflicted mankind before. Among some of its attendant symptoms are intense *bigotry* (sometimes leading to undue persecution);* an unreasoning credulity, so that all sorts of horrible stories regarding these entomological monsters are eagerly believed, and the unfortunate sufferer from these *bee-horrors* finally comes to look at every object with hymenopterous eyes. Musquitoes, for example, look as large as bees, and sting as only a super-infuriated Wenham bee can sting. It has raged fiercely at times in Germany, from the year 1530 up to the year 1800, and now, alas! has broken out among the unfortunate inhabitants of Wenham, Massachusetts, U. S. A. It would be immodest in us to suggest as a preventive against this for-

* We learn that the selectmen of Wenham have ordered the bee-keeper to abate the "nuisance," and take his bees out of town. Can it be possible! and this in enlightened Massachusetts!

midable disease, the daily reading of the NATURALIST, but we can heartily recommend the perusal of the *American Bee Journal*, which is devoted to the habits and natural history of the Honey Bee.

A little knowledge of Natural History is really the only antidote yet discovered against this fell disease. We quote from the *American Bee Journal* for March, the Editor's remarks on the subject of

BEES AND FRUIT BLOSSOMS.—A silly prejudice against bees is entertained by some fruit-growers, based on the notion that the crops of fruit are injuriously affected, both in quality and quantity, by the visits of bees during the blossoming period. A more unfounded notion, or one deriving less support from observation and science, can scarcely be conceived. Yet it regularly looms up once or twice in a century, and creates as much alarm and consternation among the wiseacres, as the appearance of a comet used to do in by-gone days.

Repeated instances of the resuscitation of this prejudice are presented in the history of bee-culture in Germany, especially in the period between 1530 and 1800. On some of these occasions it was so widely prevalent and so rabid in its demonstrations, as to constrain the almost total abandonment of bee-culture in districts where fruit-raising bore sway. To the aid of this came the substitution of cider and beer for the ancient mead or metheglin, as the popular beverage; and amid such opposition and discouragement, bee-culture rapidly sunk to be of very subordinate interest, except in some favorable localities.

In 1774, Count Anthony of Torrings-Seefield, in Bavaria, President of the Academy of Science at Munich, striving to re-introduce bee-culture on his patrimonial estate, found in this generally prevalent prejudice the chief obstacle to success. To overcome it, he labored assiduously to show that bees, far from being injurious, were directly beneficial in the fructification of blossoms—causing the fruit *to set*, by conveying the fertilizing pollen from tree to tree and from flower to flower. He proved moreover, by official family records, that a century earlier, when bees were kept by every tenant on the estate, fruit was abundant; whereas then, when only seven kept bees, and none of these had more than three colonies, fruit was scarcer than ever among his tenantry.

At the Apiarian General Convention, held at Stuttgard, in Wirtemburg, in September, 1858, the subject of honey-yielding crops being under discussion, the celebrated pomologist, Professor Lucas, one of the directors of the Hohenheim Institute, alluding to the prejudice, went on to say,—"Of more importance, however, is an improved management of our fruit-trees. Here the interests of the horticulturist and the bee-keeper combine and run parallel. A judicious pruning of our fruit-trees will cause them to blossom more freely and yield honey more plentifully. I would urge attention to this on those particularly who are both fruit-growers and bee-keepers. A careful and observant bee-keeper at Potsdam writes to me that *his trees yield decidedly larger crops since he has established an apiary in his orchard, and the annual product is now more certain and regular than before*, though his trees had always received due attention."

Some years ago a wealthy lady in Germany established a green-house at considerable cost, and stocked it with a great variety of choice native and exotic fruit-trees—expecting in due time to have remunerating crops. Time passed, and annually there was a superabundance of blossoms, with only very little fruit. Various plans were devised and adopted to bring the trees into bearing, but without success, till it was suggested that the blossoms needed fertilization, and that by means of bees the needed work could be effected. A hive of busy honey-gatherers was introduced next season; the remedy was effectual—there was no longer any difficulty in producing crops there. The bees distributed the pollen, and the *setting* of the fruit followed naturally.

THE MOTTLED OWL.—I think Mr. Samuels has misunderstood my remarks on the nests of owls. What I intended to state was that the *Mottled Owl* never built a nest to my personal knowledge, and I did not state that the *Mottled Owl* occupied the "abandoned nest of a crow or hawk," but I did state that *other species* of owls (of course meaning our local species), when they did occupy a nest at all, inhabited the abandoned nest of a crow or hawk, which they had partially repaired.—AUGUSTUS FOWLER.

An Albino Humming-Bird. — During the last summer a white Humming-bird visited many times a stand of plants on my piazza. I had several opportunities of observing it closely. It *seemed* a trifle larger than the Ruby-throat. The neck and head were of a glossy gold-color. Eyes large, black, and brilliant. After dipping its bill into all the fuschias, it did what I have never seen other Humming-birds do, alighted on a dwarf apple-tree within a few feet of me, and ate the aphides, or plant-lice, just as the sparrows and golden-wrens do. After a hearty meal of insects, it dressed its feathers, spread its wings one by one, and thrust out a very long tongue. — L. A. Millington.

ENTOMOLOGICAL CALENDAR.

In April the injurious insects in the Northern States have scarcely begun their work of destruction, as the buds do not unfold before the first of May. We give an account, however, of some of the *beneficial insects* which are now to be found in grass-lands and in gardens. The farmer should know his true insect friends as well as his insect foes. We introduce to our readers a large family of ground-beetles (*Carabidæ*, from *Carabus*, the name of the typical genus) which prey on those insects largely injurious to crops. A study of the figures will familiarize our readers with the principal forms. They are dark-colored, brown or black, with metallic hues, and are seen in spring, and throughout the summer, running in grass, or lurking under stones and sticks in

Fig. 1.

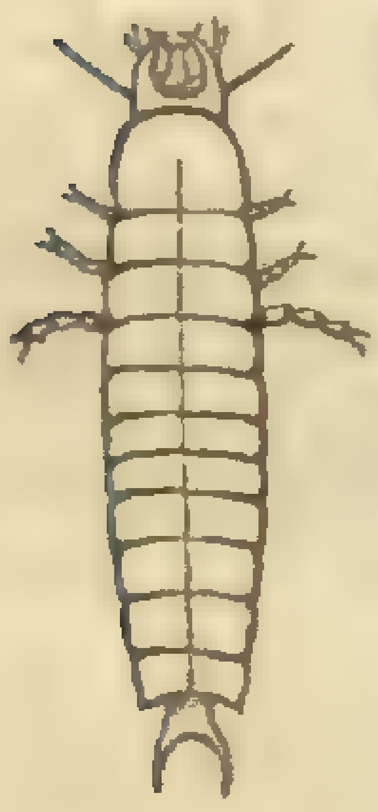


Fig. 3.

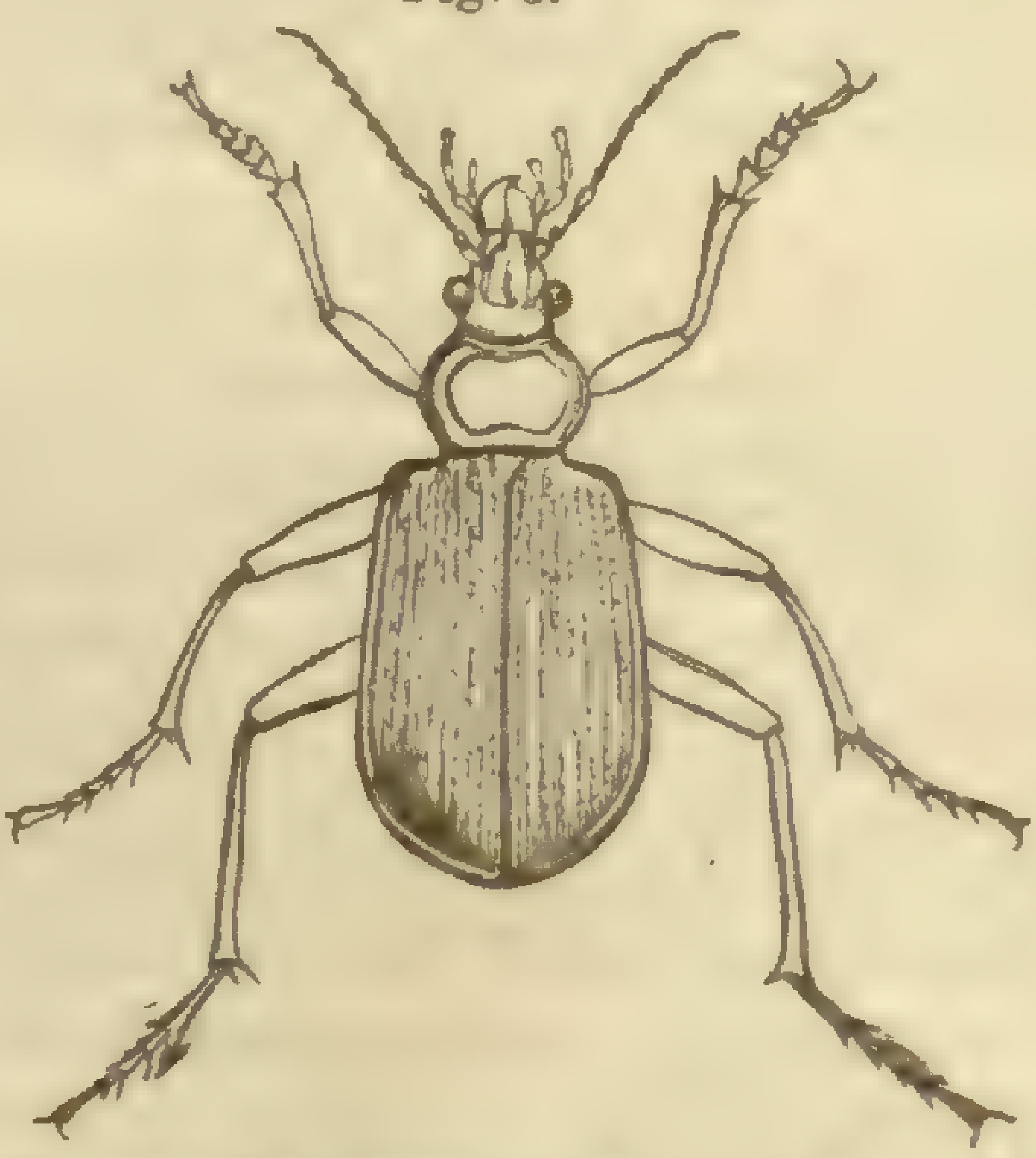


Fig. 2.

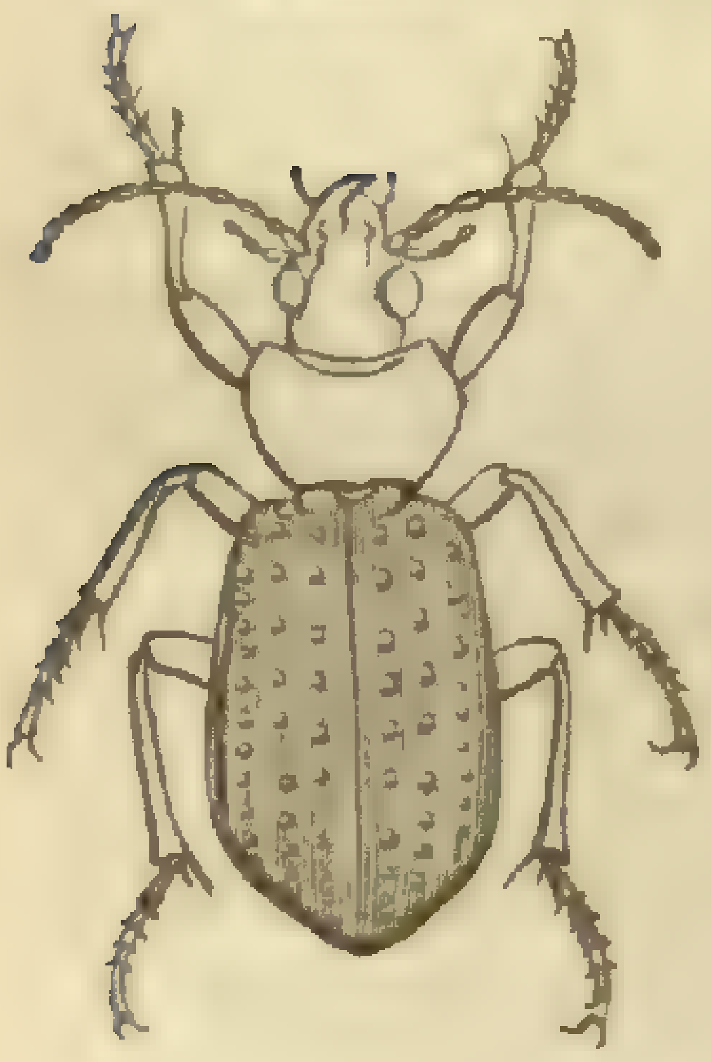
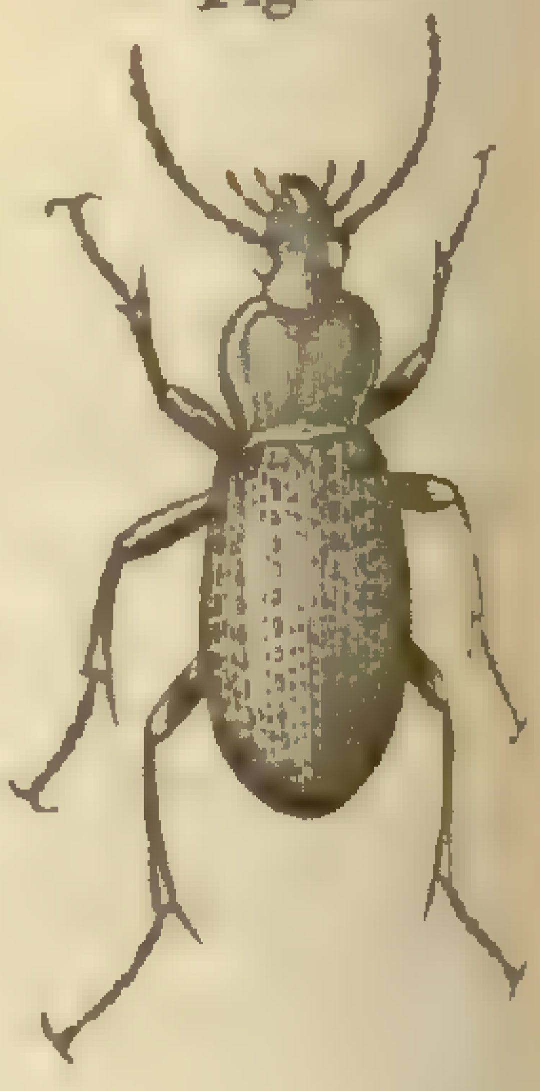


Fig. 4.



damp places, whence they sally forth to hunt by night, when many vegetable-eating insects are most active.

The larvæ are found in much the same situations as the mature beetles. They are elongate, oblong, and rather broad, the terminal ring of the

body being armed with two horny hooks, and having a single fleshy leg beneath, and are usually black in color. The larva of *Calosoma* (*C. calidum*, Fig. 1; Fig. 2, the beetle of *C. calidum* Fabr., and Fig. 3, *C. scrutator* Fabr.) ascends trees to feed on caterpillars, such as the canker-worm. When about to transform to the pupa state, it forms a rude cocoon in the earth. The beetle lies in wait for its prey in shallow pits excavated in pastures. We once saw it fiercely attack a June-bug (*Lachnosterna fusca*) nearly twice its size; it tore open the hard sides of its clumsy and helpless victim with tiger-like ferocity. *Carabus* (Fig. 4, *C. serratus* Say; Fig. 5, pupa of *Carabus auronitens* of Europe, after Westwood) is a closely allied form, with very similar habits.

Fig. 8.

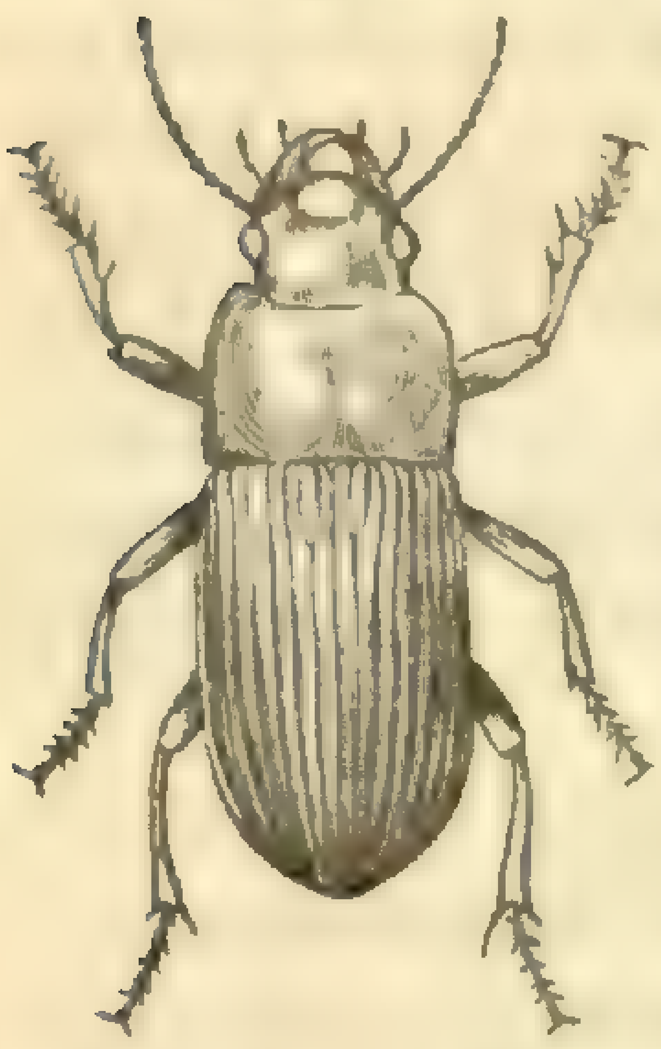


Fig. 5.

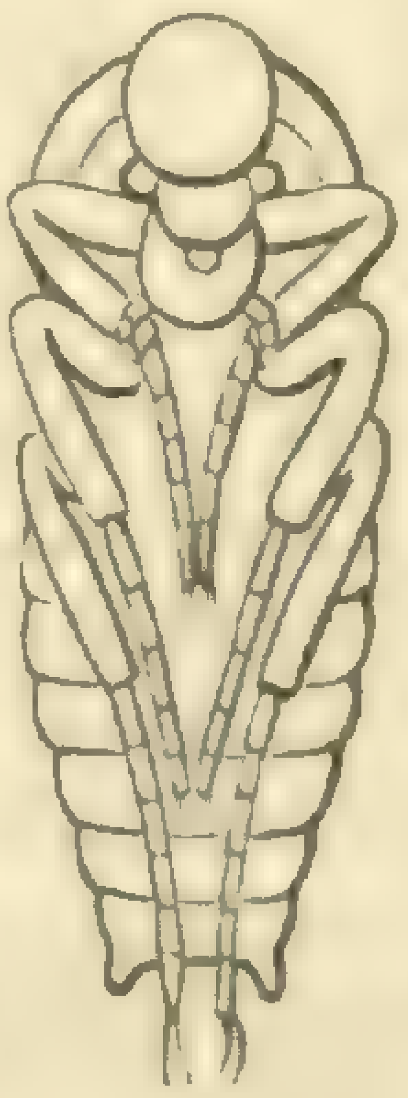


Fig. 6.

Fig. 7.

A much smaller form is the curious *Bombardier* beetle, *Brachinus* (Fig. 6, *B. fumans* Linn.), with its narrow head and heart-shaped prothorax. It is remarkable for discharging with quite an explosion from the end of its body a pungent fluid, probably as a protection against its enemies. An allied genus is *Casnonia* (Fig. 7, *C. Pennsylvanica* Dejean) which has a long neck and spotted wing-covers. Fig. 8, *Pangus caliginosus* Fabr., and Fig. 9, *Agonum cupripenne* Say, represent two common forms. The former is black, while the latter is a pretty insect, greenish, with purplish red wing-covers, and black legs.

Fig. 10.

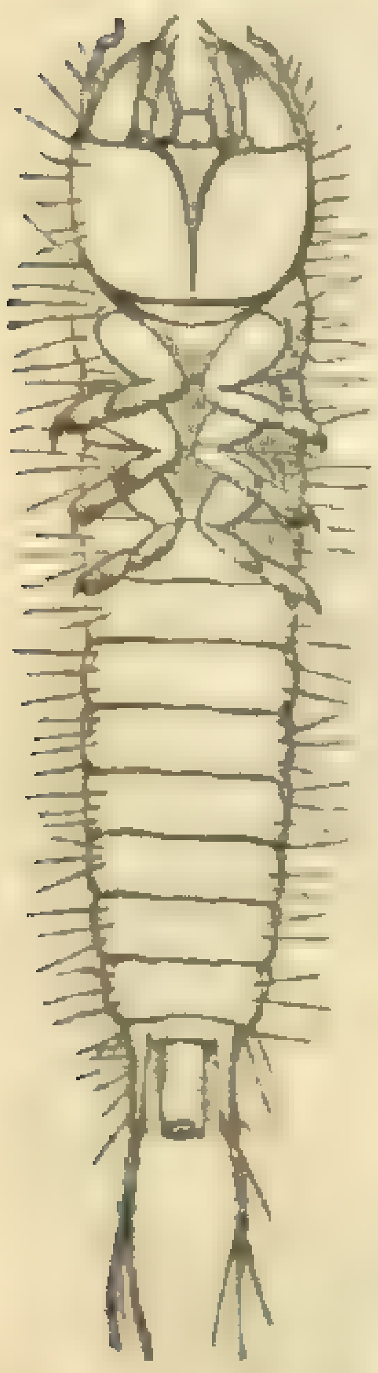


Fig. 9.

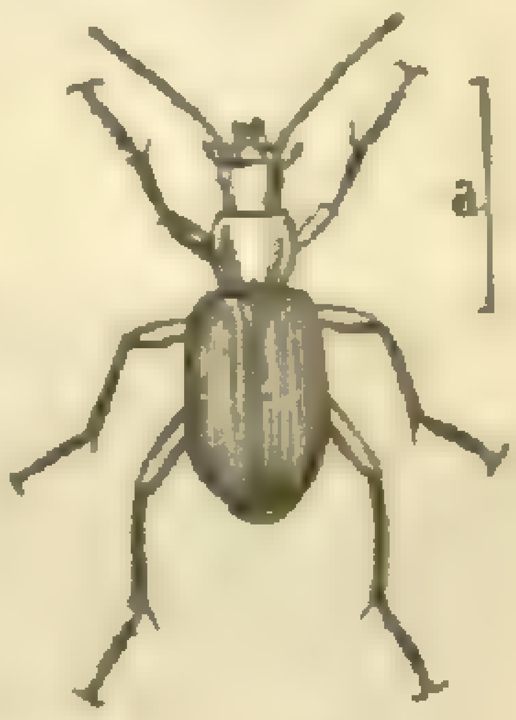


Fig. 10, enlarged about three lines, represents a singular larva found by Mr. J. H. Emerton under a stone early in spring. Dr. Leconte, to whom we sent a figure, supposes that it may possibly be a larva of *Harpalus*, or *Pangus caliginosus*. It is evidently a young Carabid. The under side is represented.

In our monthly calendar for 1868, we shall not repeat any facts stated in the calendar given in Vol. I. of the NATURALIST.

CORRESPONDENCE.

E. L. M., New York.—There is no manual of American Entomology* giving a general account of insects and the classification of the North

*The writer has ready for the press, *A Manual of Entomology and Guide to the Study of Insects*, which will be published during the year. It is designed to be a general introduction to the

American species. The following will be found indispensable, in addition to those enumerated in Vol. I, p. 106 and 160 of the NATURALIST:—

A Treatise on the Insects Injurious to Vegetation. By Dr. T. W. Harris. Illustrated. Boston, Nichols & Noyes. Reports (one to eight) on the Noxious and Beneficial Insects of New York. By Dr. Asa Fitch. Published in three volumes. The Practical Entomologist; published by the American Entomological Society of Philadelphia. The Proceedings of the Entomological Society of Philadelphia, Vols. 1–6, now continued under the name of *Transactions*. The Entomological publications of the Smithsonian Institution at Washington, containing works on the Lepidoptera, the Diptera, Coleoptera, and Neuroptera. In these important works are lists of all works relating to American insects, to which we would refer the reader.

Dr. H. Loew, in various European journals, has described many of our Diptera. The British Museum Catalogue of Insects, over fifty volumes in 12mo, describes many of our insects, and is indispensable to students.

L. A. M., Glenn Falls, N. Y.—The Sugar Mite (*Acarus saccharinum*) is found in brown sugar. It is much like the Domestic Mite (*Acarus domesticus* De Geer), which is found in collections of insects and stuffed birds, where it is quite destructive. *Acarus farinæ* is found in flour and food, and the Itch-insect (*Acarus scabies* Fabricius) forms by its irritating presence little pustules in the more protected parts of the hand and elsewhere. The Red Spider (*Acarus tellarius*) is found on house-plants. They are best destroyed by sprinkling sulphur over the leaves they infest.

BOOKS RECEIVED.

Half-yearly Abstract of Medical Sciences. July to December, 1867. Philadelphia. 8vo.

Rust, Smut, Mildew, and Mould. An Introduction to the Study of Microscopic Fungi. By M. C. Cooke. 12mo. London, 1865. R. Hardwicke. With nearly three hundred figures by J. C. Sowerby.

Manual of Botanic Terms. By M. C. Cooke. London. R. Hardwicke. With illustrations.

A Fern Book for Everybody. Containing all the British Ferns. By M. C. Cooke. Illustrated. London, 1867. F. Warne & Co.

A Plain and Easy Account of British Fungi, with Descriptions of the Esculent and Poisonous Species, Details of the Principles of Scientific Classification, and a Tabular arrangement of Orders and Genera. By M. C. Cooke. With twenty-four colored plates. 12mo. London, 1862, R. Hardwicke.

Our Reptiles: A Plain and Easy Account of the Lizards, Snakes, Newts, Toads, Frogs, and Tortoises indigenous to Great Britain. By M. C. Cooke. With illustrations. 12mo. London, 1865. R. Hardwicke.

Hardwicke's Science-Gossip for 1867. London, 1868. Royal 8vo. R. Hardwicke.

Land and Water. January 18, 25, February 1. London.

The Field. February 1, 8, 15. London.

Chemical News. March. New York.

Cosmos. February 1, 22. Paris.

American Bee Journal. March. Washington.

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study of Entomology, arranged for the use of Schools, Colleges, and Agriculturists. It will consist of upwards of four hundred pages, long primer type, with nearly four hundred cuts. It will contain short descriptions and figures of nearly all our most destructive and beneficial insects, and those useful in the arts, with remedies against the attacks of the noxious species. It is designed to be a *popular* book, written in plain language, and free as possible from technicalities, and furnished with a glossary. We shall endeavor to make it of use to the beginner in the study of insects, and especially to farmers and fruit-raisers.—A. S. P.

THE

AMERICAN NATURALIST.

Vol. II.—MAY, 1868.—No. 3.

THE SONGS OF THE GRASSHOPPERS.

BY S. H. SCUDDER.

Although every one is familiar with the notes of birds, few can distinguish the different chirpings of insects, or are even aware that every kind of Grasshopper has its distinctive note. The songs of insects are neither so varied nor complicated as those of birds, but their study presents peculiar difficulties. Sounds become inaudible to many persons when they are derived from vibrations more rapid than 25,000 per second, and when the number reaches 38,000, the limit of human perceptibility is attained: thus, the shrillness of a note may prove a hinderance to its study. This is illustrated by Tyndall in his recent book on Sound. He writes: "Crossing the Wengern Alp with a friend, the grass on each side of the path swarmed with insects, which, to me, rent the air with their shrill chirruping. My friend heard nothing of this, the insect world lying beyond his limit of audition."

Another and universal obstacle lies in the delicacy or feebleness of the notes of some species; to distinguish them

Entered according to Act of Congress, in the year 1868, by the Peabody Academy of Science, in the Clerk's Office of the District Court of the District of Massachusetts.

clearly, one must bring his ear to within a few feet, or even inches of the insect during its stridulation,—a process which requires great caution lest the shyness of the little violinist should overcome his egotistic love of song. The observer must walk quietly toward the sound until it ceases, and wait motionless for its renewal; the direction of the chirping can then easily be determined, although its distance is deceptive. After drawing an imaginary line towards the spot from whence the sound proceeds, cautious steps must be taken around the arc of a wide circle until another line is fixed at right angles to the first, and the location of the songster approximately determined. Then walking quickly but quietly to within five or six feet of the insect, the observer will fall upon his hands and knees, and produce a quill edge and file, which, on being rubbed together, imitate, with great exactness, the desired note. He will commence his mock stridulation after a short delay; at first the sounds must be subdued and separated by considerable intervals, then loud, and repeated in quick succession; usually a response is heard before a minute has elapsed, and sometimes it comes at once. When the insect has forgotten his fears and begins to stridulate violently, the observer may cease operations and carefully approach him. In this way one can place himself within a few inches of any species living in the grass.

Grasshoppers stridulate in four different ways: first, by rubbing the base of one wing-cover upon the other, using, for that purpose, the veins running through the middle portion of the wing; second, by a similar method, but using the veins of the inner part of the wing; third, by rubbing the inner surface of the hind legs against the outer surface of the wing-covers; and fourth, by rubbing together the upper surface of the front edge of the wings and the under surface of the wing-covers. The insects which employ the fourth method stridulate during flight,—the others while at rest. To the first group belong the Crickets; to the second

the Green or Long-horned Grasshoppers; to the third and fourth, certain kinds of Short-horned or Jumping Grasshoppers. The sounds produced by the different groups vary in pitch, those of the crickets being shrillest and the others following in the order just given. With but few exceptions the males alone sing.

The notes of the Cricket—called by the French "cri cri" on account of its song—may be heard near Boston* from the middle of June until November; further north they do not appear until much later in the season. Their note is *crrri*, and the rapidity with which it is uttered varies even in the same strain; sometimes it is as slow as two notes a second, at others it is twice as rapid. The note is sharp and shrill, and appears to be pitched at E natural, two octaves above middle C. Sometimes two choirs of these insects may be heard at once, the individuals of each choir chirping simultaneously, but one choir more rapidly than the other; most of the time this produces a sort of discord, but, as they occasionally harmonize, one hears cycles of accordance and discordance, often of remarkable uniformity and duration.

The Spotted-cricket (*Nemobius vittatus*) appears simultaneously with the Black-cricket (*Gryllus niger*). The chirping of the two insects is very similar, but that of the former may be better expressed by *r-r-r-u*, pronounced as though it were a French word. The note is trilled forcibly, and lasts a variable length of time. One of these insects was once observed while singing to its mate. At first the song was mild and frequently broken; afterwards it grew impetuous, forcible, and more prolonged; then it decreased in volume and extent until it became quite soft and feeble. At this point the male began to approach the female, uttering a series of twittering chirps; the female ran away, and the male, after a short chase, returned to his old haunt, singing with the same vigor but with frequent pauses; at last, finding all persuasion unavailing he brought his serenade to a close.

* All my illustrations are drawn from New England insects.

In September and October, the White Climbing-cricket (*Œcanthus niveus*, Fig. 1, left wing-cover of male, Fig. 1 *a*, the same of female*) is found on the leaves of low trees and bushes. It makes a uniform note, exceedingly shrill but attenuated.

Fig. 1.

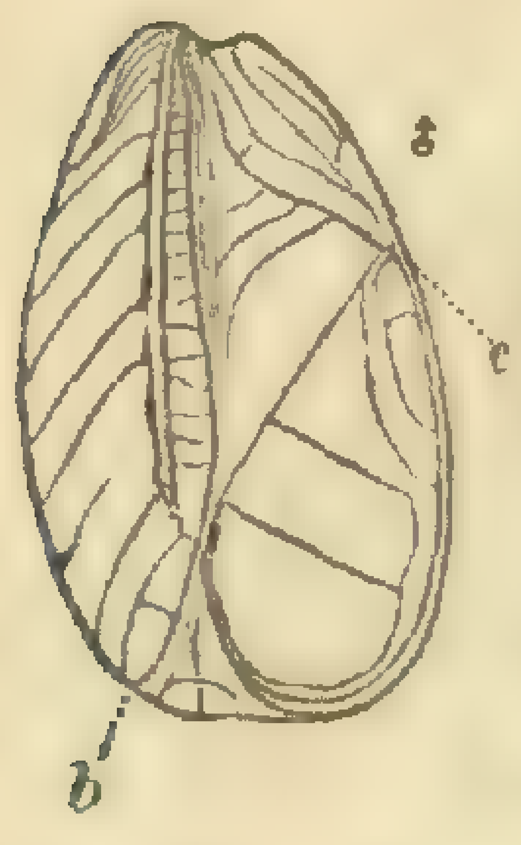


Fig. 1 *a*.

The peculiar development of the wing in stridulating Orthoptera is nowhere seen to better advantage than in this insect. In the female, the veins of the central field run nearly parallel to the border; in the male, they cross the wing in various directions, and either converge toward the point of stridulation on the inner border of the wing, where the inner and central fields meet, or act as supports to the converging veins.

All these insects belong to the first class. There are many species in the second group (the green or long-horned grasshoppers), but a few examples will suffice. These insects, like the crickets, sing both by day and night, but, unlike the latter, their day-song differs from that of the night. On a summer's day, it is curious to observe these little creatures suddenly changing from the day to the night-song at the mere passing of a cloud, and returning to the old note when the sky is clear. By imitating the two songs in the daytime, the grasshoppers can be made to respond to either at will; at night, they have but one note.

The previous illustrations showed that the stridulating organ of crickets occupied the middle field of the wing; in the green grasshoppers, on the contrary, it will be found in the inner field; here, too, the relative size of the inner field is nearly the same in both sexes, but the stout, curved vein of the male is altogether wanting in the voiceless female.

One of them, the *Phaneroptera curvicauda* (Fig. 2, male;

* In all the illustrations, the dotted lines show the limitations of the different fields of the wing; *a* represents the "file;" *b* points at the line of separation between the costal (or outer) and central fields; *c*, at that point between the central and inner fields.

Fig. 2 *a*, female), prefers to sing in the night. His day-song is *bzrwī*, and lasts one-third of a second; the night-song consists of a repetition—ordinarily eight times—of a note which sounds like *tchw*. This is repeated at the rate of five in three-quarters of a second, making each note one-half as long as that of the day.

Fig. 2 *a*. Fig. 2.

The song of the common Meadow-grasshopper (*Orchelimum vulgare*) is more complicated. Commencing with *ts*, it changes almost instantly into a trill of *zr*: at first there is a crescendo movement which reaches its volume in half a second; the trill is then sustained for a period varying from one to twenty seconds, and closes suddenly with *p*. This strain is followed by a series of staccato notes, sounding like *jip*; they are one-eighth of a second in length, and are produced at one-half second intervals. The staccato notes and the trill alternate *ad libitum*. The night-song differs from that of the day simply in its slower movement; the pitch of both is at B flat, two octaves above middle C.

A conical-headed grasshopper (*Conocephalus robustus*), found near the seashore in the southern part of New England, makes the salt marshes resound with its incessant, shrill din. The resemblance of its song to that of the harvest-fly is quite striking; at a distance, the note seems to be perfectly uniform; close at hand, one can hear it rising and falling rhythmically, two and a half times a second, accompanied by a loud droning noise.

There are numerous kinds of jumping grasshoppers which stridulate in the daytime only. They do this by the aid of

the hind legs, rubbing their thighs against their wing-covers; every movement of the fiddle-bow produces a short note, and the uniformity with which each species plays its own song is quite remarkable. One kind (*Stenobothrus curtipennis*) produces about six notes per second, and continues them from one and a half to two and a half seconds; another (*S. melanopleurus*) makes from nine to twelve notes in about three seconds. In both cases the notes follow each other uniformly, and are slower in the shade than in the sun.

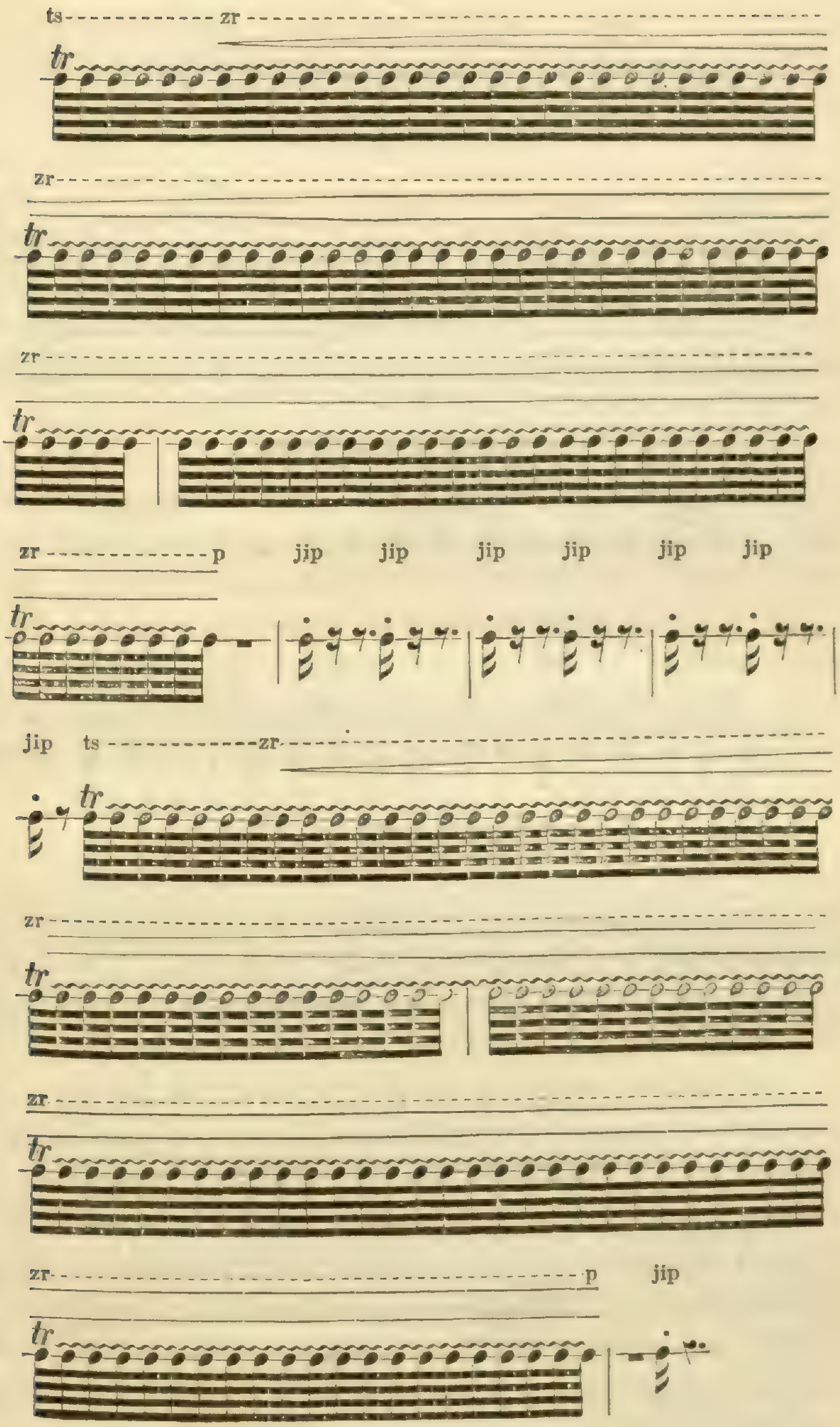
Fig. 3.

Fig. 3 *a*.

Fig. 3 *b*.

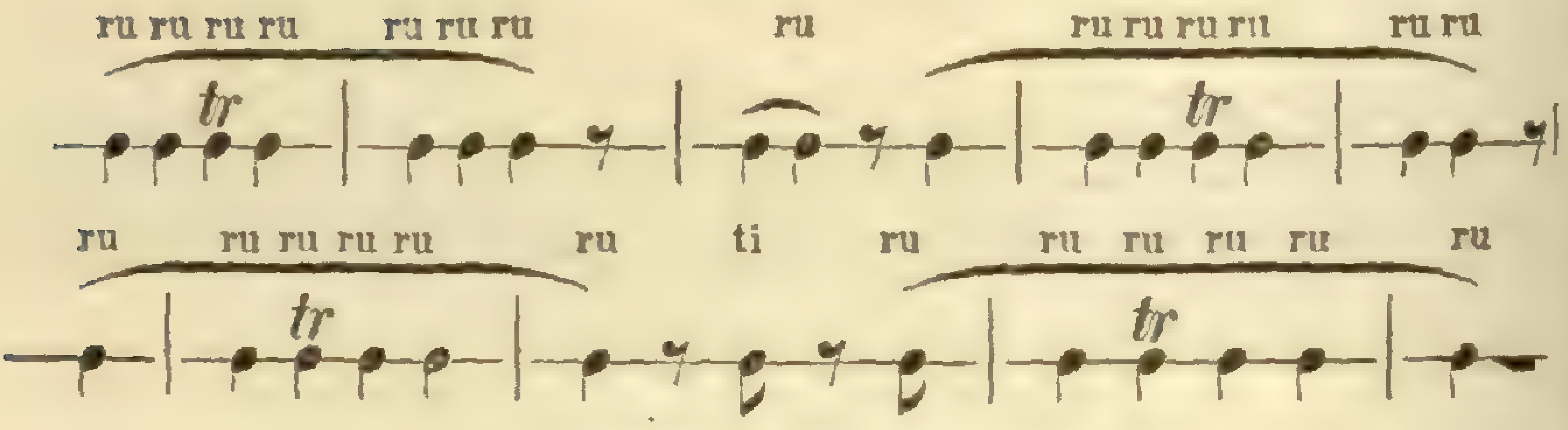
The stridulating apparatus of the jumping grasshoppers is of a very different character from that of the green grasshoppers. In *Arcyptera lineata* (Fig. 3, left wing of male; Fig. 3 *a*, left wing of female), for example, it is situated in the central field of the wing, which is of about the same size in both sexes; some of the veins in the centre of the wing (*a*, enlarged in Fig. 3 *b*) have a rasp-like surface upon which the hind thighs are scraped up and down, producing monotonous, nearly uniform notes.

The grasshoppers which stridulate during flight, by the contact of the wings and wing-covers, belong mostly to the genus *Œdipoda*; in many of them the wings are variegated with brilliant colors. The sound which they make seems to be under the control of the insects, for they often omit it when alarmed. Some species produce a uniform, rattling noise during the whole of their undeviating flight; others make it only during the intervals of flight, and seem to stridulate more at will. The flight of the latter is more sustained, they are capable of changing their course, and at each turn emit a crackling sound of short duration.

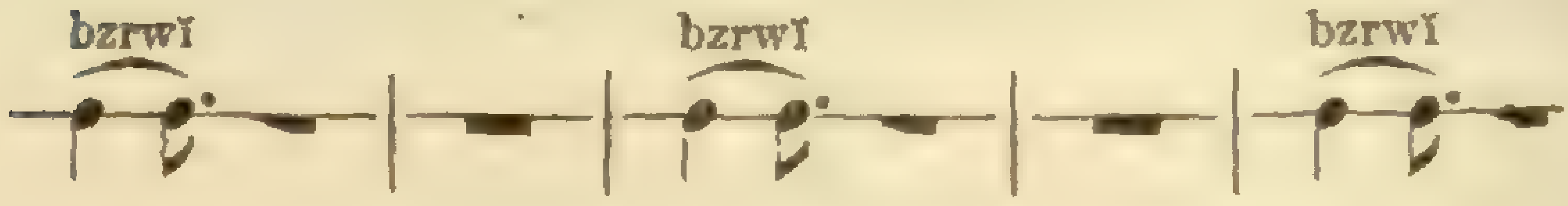


Note of Orchelimum vulgare.

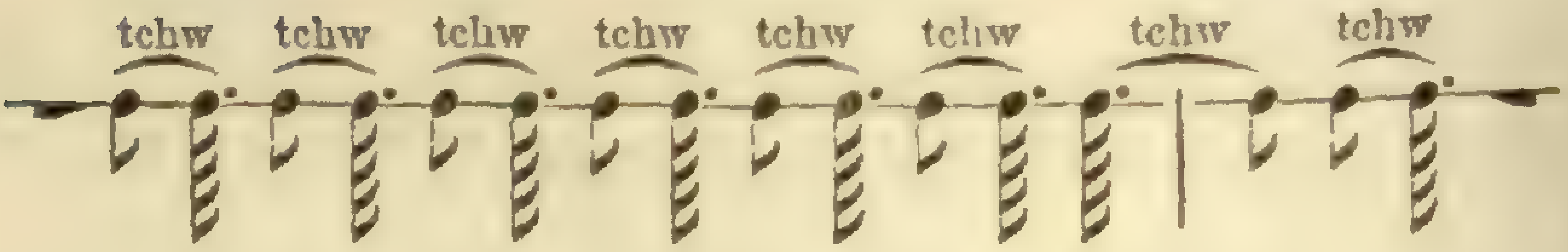
Note of Gryllus neglectus.



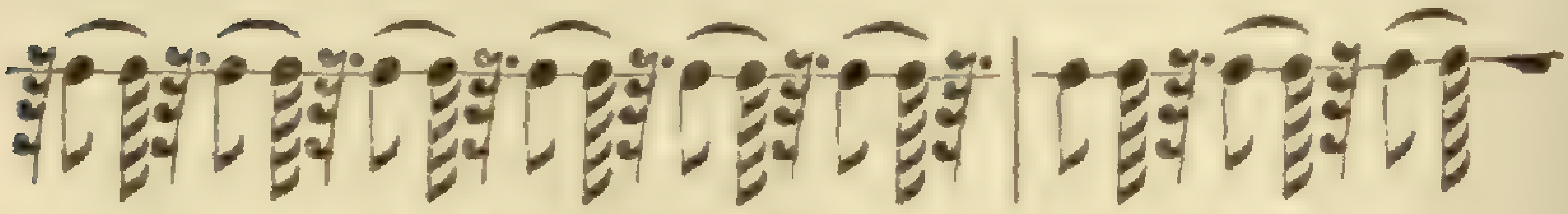
Note of Nemobius vittatus.



Note of Phaneroptera curvicauda by day.



Note of Phaneroptera curvicauda by night.



Note of Stenobothrus melanopleurus in the sun.

Note of Stenobothrus melanopleurus in the shade.

Note of Stenobothrus curtipennis.

Note of Arcyptera lineata.

BEARS AND BEAR-HUNTING.

BY CHARLES WRIGHT.

"NOTES of a Hunter," by Henry Clapp, call to mind some personal experience about bears and bear-hunting in Texas. I was much in the company of Mr. Benjamin Burke, a very observing, intelligent, and truthful man. He imparted to me many items of information respecting the habits of the bear. Some of these habits I had the opportunity of observing myself, and I have full confidence in the truth of his statements relative to the others.

I had read in my youth, in some great encyclopedia, that the bear goes to his winter's sleep very fat, and awakes from it, in the spring, very lean. I was surprised then to learn, that, so far as can be judged by appearances, he loses none of his fat during hibernation. Of course, in his wild state we cannot weigh him before going to sleep and after he wakes. The hunter says he goes to his winter-quarters "full fat," and comes out "full fat." *I* know that he is fat when he begins to travel in the spring; but he becomes lean rapidly, notwithstanding he may find plenty to eat. At this period, he is destructive to hogs; indeed, all the summer, till the return of mast (acorns, grapes, and other autumn fruits) offers him better food. Mr. Burke had a very large, gentle boar (he was raised as a pet) which was caught by a bear; but he broke away, and came to the house with a gaping wound just over the middle of his back. A *gang* of hogs will rally, in self-defence, against a wolf, a panther, or any other animal of this country that I know of, except a bear. If you want to scatter a gang, throw among them a bit of fresh bear-skin. Apropos of this a story is told, for the truth of which I do not vouch, though I think it not improbable, that a man's hogs being in the habit of breaking into his neighbor's field, the latter caught one, sewed it up in the skin of a bear newly killed, and turned it loose among

its fellows. These ran for dear life, and the bear-hog followed from social instinct till both fell, if not dead, at least quite exhausted.

I was not aware that a bear can climb a tree so small as that mentioned by Mr. Clapp. The hunter knows whether the animal is in the hollow of the tree above by the marks of the claws. In ascending, he leaves only the puncture of the claws. In descending, he makes long scratches. They climb in order to "lap," as the hunter says, described by Mr. Clapp as drawing in branches to get the fruit. I feel inclined to doubt whether they break off the branches *for the purpose of throwing them down and then descending to eat the fruit.* It looks too much like human reasoning. If the branch breaks, he may not be able to hold it; and when he goes down, he may eat the fruit. This would be all natural enough. In the South, acorns form the principal mast. They are fond of persimmons too, and grapes. When mast is not plenty, they lap black-gum berries (*Nyssa multiflora?*), and these impart to the flesh, not a bitter taste, as would naturally be supposed, but the peculiar savor of fish; so that, for a person of delicate taste, only severe hunger will force him to eat the meat of a bear that has lapped black-gum.

The female commonly climbs a tree to find a hollow for her winter-quarters, where she has her cubs. I was present at the taking of one from such a hollow. It was necessary to climb a neighboring tree; then a piece of dry rotten wood set on fire, loosely attached to a pole and thrust into her nest, soon forced her to turn out. Old, large bears do not like to climb, and generally hibernate in a thick bunch of cane or bushes, or among some fallen tree-tops, or in a hollow log, making a bed of leaves, grass, brush, or other stuff. During winter, if a warm day occurs, bears will sometimes go out and walk about, and perhaps drink; but they, probably, do not eat. One killed during the winter has nothing, or only a little mucus in the stomach and intestines, and the plug in the vent, as mentioned by Mr. Clapp.

This results, probably, from the hardening of the last fecal matter, mostly mucus, which comes from the intestines. But the idea that it is composed of gum,—an idea that I never heard of in Texas,—entertained by some, reminds me of another custom of bears, probably connected with the sexual heat. In some localities, particularly on a high bluff near a stream, a pine tree is occasionally seen, from which the bark, at a certain height, is plainly torn off by the teeth of some animal. It is said to be done by the bear in this manner: he rises on his hind feet with his back to the tree, and, turning his head to one side and to the other, rips off the bark with his tusks. The size of the animal is known, approximately, by the height of the marks he leaves. The same tree is visited year after year by bears of various sizes,—none very small, however. I would say, trusting to memory, that the average height may be about four feet. I have seen several such trees. I think Mr. Burke had never witnessed this performance, but received his information from Indians. I never saw any other than a pine thus marked.

Bears are fond of honey, and will rob bee-hives, if within reach. They also dig up "yellow-jackets," wasp's-nests, for the larvæ. The account of this is amusing. The animal digs rapidly, and when the insects sting him too fiercely he quits for a moment, rolls over and over on the ground, snarling the while, and returns again to the attack, perhaps to go through the same movements several times before he bears off the prize.

It is exciting sport hunting bears with dogs. These come to be almost as fond of it as the hunter himself. Most of them, in the beginning, fear to attack, and some never get the better of the dread he inspires. A fierce one is apt to spring at the ear, to his sorrow. But the dog that has courage and prudence combined bites him behind, which he will by no manner of means tolerate, but will wheel to fight. I doubt if he ever properly strikes with his paws. He makes

his own instinctive effort to seize the attacking party, and to put him in the place of the lowermost dog in the fight. Then he bites, and if he gets the dog by the back, and if this be a lean thin dog, woe be to the dog. A fat one has a better chance. The bear cannot so well get his broader back into his mouth, and, the skin slipping, he generally escapes with only a flesh-wound. Dogs, at first, often refuse bear-meat, but come to prefer it before all others, as does the hunter.

When hard pressed, the bear will back into a dense patch of cane or into a bunch of bushes, and, standing erect on his hinder parts, make the best fight he is capable of. This is the time for the hunter, when his attention is absorbed by the dogs. Occasionally one is started, which runs steadily on and escapes. Females and young commonly climb, or "tree" in hunters' dialect. Generally, they are then easily shot; but sometimes, on the hunter's approach, they will drop from the tree and run on again.

I once met a female and two cubs. I shot the mother fair in the breast, aiming at the white spot. The cubs treed, and I killed them; I then went in search of the old one, fully expecting to find her, close by, dead. As she ran away she bled profusely, but the blood grew less, and finally stopped entirely, and I never found the bear. How she could go quite off with such a loss of blood, was a mystery.

THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

BY SIDNEY I. SMITH.

(Concluded from page 23.)

AMONG terrestrial and fluvial species, topography is much more powerful in limiting geographical distribution, than it is among marine species. The separation of lands by broad ocean waters, without change of temperature, is sufficient to

prevent the mingling of their land faunæ to any extent, while they may have most of their marine species in common. Such cases are numerous; at the Galapagos, for instance, none of the truly land species are known to occur in any other region, while a large portion of the marine species are found also on the American coast. Temperature is undoubtedly the most effective cause in limiting the diffusion of land and fresh water, as well as marine animals; but its influences are much obscured by those of humidity, and by the varying character of soils, waters, and the resulting vegetation.

Temperature, as a result of or combined with topography, forms a very effective force in limiting the distribution of land animals. High and continuous mountain ranges present an almost impassable barrier to the migration of most species. Thus the physical features which separate faunæ from regions east and west may be so strongly marked, that they more than counterbalance the climatic effects of latitude. In North America, the faunæ on the east of the Rocky Mountains are very different from those on the west, and the inclosed central table-lands are occupied by still different faunæ. The birds of Arizona resemble those of the table-land of Mexico rather than those of California or of Texas. These physical features even effect a change in the migrations of the birds of this region; many of the birds of the Colorado valley, instead of migrating far to the north in summer, turn to the east and breed in the region north of Fort Whipple.*

Climatic influences, almost alone, limit the distribution of mountain vegetation; and, through the vegetation, more than directly that of mountain animals. The narrow limits within which mountain species are restricted show very plainly the effect of climatic influences. Among the butterflies of the White Mountains of New Hampshire, the abundant *Chionobas semidea* Edw., is restricted to the loftiest summit, never

* Dr. E. Coues, Prodrome of a work on the Ornithology of Arizona Territory, noticed in the NATURALIST, Vol. I, p. 209.

breeding without these narrow limits, although frequently blown into the lower vallies. In a zone below these lofty summits, but not extending to the base of the mountains, *Argynnis Montinus* Scudd. is found, yet never at the summit with the *Chionobas*, nor about the base with the species of the Canadian or Virginian faunæ.* Many other species of insects, and many plants, are restricted in the same manner. It cannot be that these species are thus restricted in their distribution merely by some primary, innate principle, which prevents their diffusion; for, like their marine relatives, they have not always been thus restricted.

It is not so easy to trace these migrations of species on the land as it is in the ocean, for land species are not so often left fossil in their ancient homes; and, as there are no authentic records of land animals existing through the Glacial epoch, we can go back no farther than its decline. Yet it is worthy of remark, that the arctic land fauna of the Tertiary period, like the marine, was probably circumpolar; and that the gradually advancing cold of the glaciers would have driven many arctic plants and animals southward, and, living just beyond the border of the ice belt, they would have followed it back with the glacial decline.

At the close of the Glacial epoch, the fauna and the flora of New England must have been very much like that of the coast of Labrador at the present time. As the climate became gradually warmer, the more hardy species would have retreated northward and up the mountain sides, while others less hardy, became extinct during these climatic changes. As the migration continued, the mountain summits were left as aërial islands in the more southern faunæ.†

The known land fossils of this period of change are as yet very few, but the faunal migration has left abundant evidence in the northern species scattered along its path

* S. H. Scudder, Remarks on some Characteristics of the Insect Fauna of the White Mountains. Journal of the Boston Society of Natural History, Vol. VII.

† Packard, Glacial Phenomena of Labrador, p. 256.

upon the mountains, or wherever the climatic or topographical influences have not annihilated them.

The flora of the higher mountains of New England and the Middle States is quite identical with that of higher North American latitudes. All the plants of the White Mountains are now growing upon the coast of Labrador. As might be expected, the fauna of these mountains agrees with the flora. The larger animals would not, of course, be expected to occur in so restricted an area; still, one or two northern birds are found in summer, and many species of insects—Coleoptera, Diptera, Lepidoptera, and Orthoptera—are common to the mountains and places farther north. There are, however, some forms which appear to be peculiar to the mountain fauna, but more careful and extended investigation in the northern regions may prove many or even all of them to belong to species still existing at the north.

The plants and the birds of the coast of Maine, where the cooling effect of the arctic current is still felt, are subarctic in character, and very different from those inland. *Potentilla tridentata* and *Alsine Grœnlandica*,* species characteristic of the flora of Labrador and the New England mountain summits, with *Pupilla badia*, still linger as far south as Portland. Thus upon the land, as in the ocean, there are southern outliers of northern faunæ which are relics of the northern march of life during the close of the Glacial period.

The influence of winds in animal distribution is very slight, and seems wholly a disturbing power; yet it should not be passed over in silence, for it helps explain the wonderfully wide diffusion of a few species. The winds may transport animals great distances, even over oceans, and drop them alive among the species of other faunæ. Several of our American birds have been carried thus to Europe so

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* At Paris, Maine, about forty miles north of Portland, and just on the coast line of the Leda Clay epoch, I have found both these arctic plants springing from the gravel in a railway cut, as if to mark their home of a former age. The occurrence of *Sedum Rhodiola* in Bucks county, Pennsylvania, mentioned by Professor Porter in this volume of the NATURALIST, p. 39, is a much more interesting relic of the Glacial epoch.

often, that they are now catalogued as British species, although they are never known to breed there; and European species have frequently been taken upon the American coast. It is not very probable that land birds have crossed the Atlantic in this way and become established in the opposite country, but in the case of northern aquatic birds, it is by no means impossible that whole flocks may have crossed the ocean, and become inhabitants of both shores of the Atlantic. Most of the birds that are common to Europe and North America are arctic aquatic species. With insects there is a still greater chance of being carried from country to country by winds. That they have never been known to cross the ocean, as birds, is very poor evidence that they do not do so, for hundreds might arrive yearly and not be noticed. Insects have frequently come upon vessels at great distances from land, and there is no reason why they should not be carried by winds as far as birds. Once arrived in a new country, the chances of their becoming permanently established are very much greater than for birds, for a single female with eggs might be sufficient to introduce the species. Some of the facts mentioned below in regard to the introduction of insects through man's agency, show how easily they may become established.

Of the organic causes in animal distribution, the influence of animals themselves is very slight compared with that of man. Still, many species, carried by the winds or by man's influence from their original homes into other regions, are destroyed by native carnivorous species, their permanent introduction prevented, and the mingling of far-separated faunæ somewhat lessened. The effect produced by animals in diffusing other species is perhaps greatest in carrying parasites from place to place. A species is seldom introduced without some of its parasites, and it might even introduce them without becoming introduced itself, for parasited cocoons and eggs of insects, or living insects and other animals infested by parasites, might be carried great dis-

tances, and the parasites thus introduced attack other species.

Man, with boundless aspirations and governed in all things by an influence within himself, is given a power in nature second only to his Creator; with control over physical causes, he is governed by no laws of geographical distribution, and, traversing the whole earth at his will, he has carried, in spite of climatic influences, species from continent to continent, and almost from pole to pole. His influence—far above all other secondary causes, and uncontrolled by the laws imposed upon mere animals—seems only a disturbing force among the naturally harmonizing laws of the diffusion of life. Many of the changes which man has wrought in the distribution of animals are so evident and so universally understood, that it is useless to refer to them here, and we will allude only to some of those which bear more directly upon our understanding of the geographical distribution of species.

By changes in the minor physical features of regions, man has often adapted them to species of other regions. The Cliff-swallow was formerly known only from far west of the Mississippi, where there were extensive limestone cliffs for it to nest upon; but now that the buildings of man have made places for its habitation, it has spread from the Mississippi all over the Atlantic States.*

The New Potato-beetle (*Doryphora 10-lineata*), which is so destructive in the West, was long ago known at the base of the Rocky Mountains in Colorado, feeding upon a wild species of *Solanum* peculiar to that region. Civilization, pushing westward, at last extended its fields of cultivated plants far west of the Mississippi into this region. The potato (a species of *Solanum*) was well adapted to feed the beetle, and was of course attacked by it. The broad fields of cultivated plants were much better fitted for its increase than the scattered wild ones, and it rapidly diffused itself

* A. E. Verrill, Proceedings of the Boston Society of Natural History, Vol. IX, p. 276.

eastward. In 1864 it had crossed the Mississippi, and now it has covered half of the State of Illinois.*

Three common species of butterflies in Eastern North America,—*Vanessa Antiopa*, *Cynthia cardui*, and *Cynthia Atalanta*,—long known to be identical with European species, have been asserted to be natives of this country, and the possibility of their introduction from Europe has recently been questioned.† But, within a very few years, there has been a well-authenticated instance of the naturalization of an European butterfly in Canada. *Pieris Rapæ*, the Cabbage-butterfly of Europe, was introduced at Quebec about 1859, and, in 1863, it had become very abundant within a circle of forty miles radius about that city.‡ If butterflies are introduced and spread so rapidly now, there is no reason why the other butterflies mentioned, all of which feed upon introduced plants, should not have been introduced and diffused over all the eastern part of the country long before entomologists began to study the distribution of species.

Man's influence is perhaps more noticeable in restricting the range of, or wholly destroying many species of animals. Within a few centuries several of the largest birds have become extinct through his agency, the larger wild animals have been mostly driven from civilized countries, the relative abundance of the different classes of animals has been materially changed, and the natural harmony which must have prevailed in the distribution of life has been destroyed. for man cannot change the relative abundance of a single species without affecting indirectly myriads of animals.

If man has wrought such vast changes within the short period of our written history, what must be the sum of all his influence in past ages? Is it too much to say that his influence aided in the extermination of those monsters of the

* B. D. Walsh, Practical Entomologist, October, 1865, and November, 1866.

† Ibid., On certain Entomological Speculations of the New England School of Naturalists. Proceedings of the Entomological Society of Philadelphia, Vol. III, p. 207.

‡ G. J. Bowles, On the Occurrence of Pieris rapæ in Canada. Canadian Naturalist, Vol. I, No. 4, August, 1864.

last geological epoch, the Mastodon, the Irish Elk, the Cave-bear, and all those wonderful animal forms that passed away with the appearance of man?

THE PRONG-HORN ANTELOPE.

BY W. J. HAYS.

THE PRONG-HORN ANTELOPE.
From Tenney's Zoology.

In a recent number of the NATURALIST is a letter from Dr. Coues on the animals of our Western plains. Among other quadrupeds he describes the *Antilocapra Americana*, or Prong-horn Antelope, and says that they do not shed their horns. It is somewhat strange, that, although this animal has been known so long, so little is known of its habits.

A few years since Professor Baird received a letter from Dr. Canfield, who had spent some years among these animals, announcing the fact the antelope did actually shed its horns.

As this animal has always been supposed to belong to that class of ruminants called hollow-horned, the same as the cow, sheep, and goat, Professor Baird looked upon the statement as a delusion of the writer's, and paid no farther attention to the matter, until, in 1865, a young male antelope was taken to the Zoölogical Gardens of London; this was the first animal of the kind ever taken to Europe.

One morning the keeper discovered that one of the horns

was loose, and, supposing that some injury had been done to the animal, he immediately called for Mr. Bartlett, the superintendent of the garden, when, upon further examination, they found that both of the horns were about to fall off. This was the first account published of this interesting fact. The account will be found in the Proceedings of the Zoölogical Society of London for 1865.

For the last four years I have had an antelope under my own observation, and have watched carefully the process of development of the horns.

The antelope fawns are born in the spring, and when six months old the horns first begin to develop. They continue to grow until the next October or November (that is, until

The horn just shed. A longitudinal section showing the manner in which the hairs pass through the horn. The appearance of the horn in the month of January. Its appearance in April.

the animal is eighteen months old), when the first pair of horns are shed; by this is meant the outside shell. Like the cow and sheep there is a horn-core formed by the prolongation of the frontal bone, and occupying about two-thirds of the interior of the horn. When the horn drops off, the horn-core is found covered with a thick skin, and coated with hair, the same as the face of the animal, with a small portion of the tip having already begun to harden; this acting as a wedge, forces the horn off.

The new horn continues to grow from the tip downwards, and generally to curve inwards; at the same time the thick skin below continues to harden, at first assuming the appearance of black leather. It is flexible, so that the tip may be bent in any direction; a prong sprouts from the base, and, by the middle of summer, the horns are fully developed, to be dropped and again renewed in the autumn.

The horn, when shed, seems to be a mass of agglutinated hairs enclosed by a substance resembling whalebone in appearance; some of the hairs, however, never amalgamating with the horn, but retaining their natural condition, and, passing entirely through the horn, will be found protruding on the inside and outside of the horn.

The animal, from which I have made the drawings, is now developing his fourth pair of horns. The second pair of horns were about three inches longer than the first, and the same difference existed between the second and third pair.

EXPLANATION OF PLATE 3.

Fig. 1. The animal in October, immediately after shedding the horns.
Fig. 2. Appearance in August, the horns being perfect.

DO SNAKES SWALLOW THEIR YOUNG?

BY F. W. PUTNAM.

"WELLSVILLE, N. Y., Sept. 4, 1867.

"EDITORS AMERICAN NATURALIST:

"SIRS, — A short time since I was in Condersport, Pa., in whortleberry time, and a man who had been out berrying stated that he suddenly came across a Rattlesnake with her young, some twenty-six,* about her.

* In regard to the number of snakes in a brood, very little is known. Twenty-six seems to be rather a large number for a Rattlesnake, taking my own observations as a guide, for of two female Rattlesnakes (*Crotalus durissus*) which I dissected, one had nine and the other eight fully formed eggs in the oviducts, though there were a number of small ones (not quite as large as peas) which had probably been impregnated and might have become developed before the others were excluded, but which appeared to

She immediately opened her mouth, and instantly the whole family of little ones went down her throat. Do you believe it? Is that the nature of the Rattlesnake? — H. M. S."

THE above question has been often asked, and we have several times received statements similar to that expressed in the foregoing letter, which, while difficult to believe, it is hard to doubt without questioning the veracity of a large number of persons, and it seems to the writer that the principal point to prove now is, *Do young snakes, after entering the throat of their parent, come out again alive?*

In answer to this last form of the question we can say, that frogs *can* live some time in the œsophagus of a snake; and if so, why cannot young snakes do the same? for apparently snakes have as great a power as frogs to live under circumstances that would deprive more highly organized animals of life. — To my proof about the frog:

Last summer Mr. Hyatt met with a common Striped-snake which had recently enjoyed a meal, indicated by a large bunch near the centre of the body. Mr. Hyatt was led, by the very common desire which most naturalists have of

me as if they belonged to a second brood. In a specimen of a closely allied genus (*Crotalophorus miliarius*) fourteen eggs were counted in the oviducts, each egg containing an embryo about two inches in length, in which the fangs were developed. In a specimen of the common Striped-snake (*Tropidonotus sirtalis*) thirty-five inches in length, collected on the 22d of July, I found forty-two nearly developed young in the oviducts, each of which was five and a half inches in length, making a combined length nearly equal to seven times the total length of the parent. July 13th I caught a female of the Garter-snake, as it is often called in Massachusetts (*Tropidonotus sauritus*), which had nine eggs, each of which was three-fourths of an inch in length, and contained an embryo two and a half inches long. On July 31st I captured another of the same species which had evidently just excluded part of her brood, as there were but four eggs in the oviducts just ready to be burst by the young. These eggs were each one inch and a quarter in length, and contained young measuring five and a half inches. On August 30th, I found the eggs of the common Green-snake (*Coluber vernalis*), seven in number, just under the old bark and moss of a decayed stump in a meadow. These eggs, which were just on the point of hatching (one young was already partly out of the egg, and two others came out before I reached home), were an inch in length by half an inch in diameter, and the young snakes were five and thirteen one hundredths inches long. Several years ago a family of twenty-two young Water-adders (*Tropidonotus sipedon*), each about eight inches in length, were found together and presented to the Museum of Comparative Zoölogy, Cambridge, by Dr. Chaplin. These few notes are all that I have relating to the time of breeding of our snakes and the number of eggs to a brood, and I can assure any of the readers of the NATURALIST who feel disposed to collect female snakes during June, July, August, and September, that they would be very acceptable to our collection.

experimenting on animals that come in their way, to try the temper of the snake, which he did by teazing it with a stick. This amusement, in a short time, apparently made the snake sick, and the "bunch" was observed to move towards the head. In a few moments more *a live frog** *was seen trying to get out of the snake's mouth*, which, after a hard trial and a good many jerks and kicks, it succeeded in doing, and jumped off highly delighted at making its escape from such close and uncomfortable quarters. This little incident proves that a frog can live a considerable time in the œsophagus of a snake; and any one desirous of witnessing the power which snakes have of maintaining life under equally trying circumstances, need only attempt to drown one, or kill it by placing it in a tight jar. If, instead of making the cruel experiment, the reader will take our word for it we can assure him that snakes have been known to live for some time immersed in water, and "bottled up" in alcohol.

Thus, with the above facts before us, what reason have we to doubt that young snakes can live in the dilatable throat of their mother long enough for her to carry them to a place of safety? and why should not young snakes have this means of protection given to them? It is really a provision no more wonderful than that with which young kangaroos, opossums, and other marsupial mammals are provided in the pouch of their mothers; or the young pipe-fishes and sea-horses in the singular pouch or abdominal fold of their fathers, into which the young go for protection or for rest.†

One might easily believe, that, if the old snake should take the young into her throat in a moment of danger, she might afterwards, on being pressed by hunger, be strongly tempted to work them down a little farther and provide herself with a good dinner already at hand, especially as large

* Rana palustris.

† I have seen the young of our common Pipe-fish (*Syngnathus Peckianus*), kept in an aquarium, go in and out of the "pouch" of the male fish.

snakes are known to feed on smaller ones;* and that it would be almost too much to expect that an animal, which to our higher natures seems so cold in its disposition, would stop to consider the fact that it was her own children she had in her throat before forcing them into her empty stomach. But here again are we met with facts that should set this doubt at rest; for certainly we must allow that her Snakeship is as highly endowed with motherly feeling as several species of fishes which live in the waters of South America, and which are known to carry their eggs in their mouths until they are hatched, and the young have attained considerable size; and yet, though the mouths of these fishes are so full of eggs or young that they cannot take food without either unloading their mouths or swallowing their eggs, yet they are not known to swallow eggs which they have taken in charge. With this well-known case of forbearance on the part of fishes, are we not justified in believing that snakes would have an equally motherly regard for their offspring?

It has been given as a reason against the probability of snakes taking their young into their throats, that the gastric juice would destroy the life of the young ones in a short time; but this is not the case, as we know from the instance of the frog that life is not immediately destroyed. The gastric juice, too, would not affect any animal until it was received within the stomach, and probably not even then until life was destroyed by suffocation.

The belief that the young of several species of snakes do enter the mouth of the parent for protection, has prevailed for a long time, and, in many countries. A similar belief is very prevalent among sailors and sea-faring men, regarding many species of sharks which are thought to take their young into the mouth to protect them from danger.†

* On opening a large Black-snake (*Coluber constrictor*), a full-sized Green-snake (*Coluber vernalis*), and a full-sized Brown-snake (*Tropidonotus occipitomaculatus*), were found in its stomach and adjoining part of the œsophagus, with those portions in the stomach in a slightly decomposed condition.

† Some sailors believe that the young sharks, which are often seen to suddenly dis-

In a conversation with Professor Wyman some time since, that eminent physiologist stated that he did not know any reason why young snakes could not live for a time in the throat of the parent, and also called my attention to the prevalence of the belief in former times by a quotation from Spenser's "Faerie Queene," in the first canto:

XIV.

"But, full of fire and greedy hardiment,
The youthfull Knight could not for ought be staide;
But forth unto the darksome hole he went,
And looked in: his glistring armor made
A litle glooming light, much like a shade;
By which he saw the ugly monster plaine,
Halfe like a serpent horribly displaide,
But th' other halfe did womans shape retaine,
Most lothsom, filthie, foule and full of vile disdaine.

XV.

"And as she lay upon the durtie ground,
Her huge long taile her den all overspred,
Yet was in knots and many boughtes upwound,
Pointed with mortall sting: Of her there bred
A thousand young ones, which she dayly fed,
Sucking upon her poisnous dugs; each one
Of sundrie shapes, yet all ill-favored:
Soon as that uncouth light upon them shone,
Into her mouth they crept, and suddain all were gone.

* * * * * * * *

XXV.

"Her scattred brood, soone as their parent deare
They saw so rudely falling to the ground,
Groning full deadly all with troublous feare
Gathred themselves about her body round,
Weening their wonted entrance to have found
At her wide mouth; but being there withstood,
They flocked all about her bleeding wound,
And sucked up their dying mothers bloud;
Making her death their life, and eke her hurt their good."

We have quite recently received from Mr. Cooke, the editor of "Science-Gossip," London, several of his instruc-

appear while swimming about the parent fish, are taken into the mouth of the parent, while others think that they enter at the genital opening.

tive and interesting little works on popular Natural History, and among them "Our Reptiles"* which contains such confirmations of some of the statements given in this short sketch, and so many well-authenticated accounts of snakes taking their young into their mouths for protection, that we quote the following passages.

On page 50, in writing on the food of the common English Snake, which is the European representative of the common Striped-snake of America, and closely allied to it in its habits, he gives the following quotation from Mr. Bell: "I once saw a very small one [frog], which had been swallowed by a large snake in my possession, leap again out of the mouth of the latter, which happened to gape, as they frequently do immediately after taking food." And again on the same page he writes: "During the present summer, a gentleman of our acquaintance saw a lad kill a snake in the wood. It was a very large one, and the boy cut it open along the under surface with his pocket-knife. By this means a full-sized frog was liberated from the stomach of the snake. It was very lively and soon hopped away. Why may not young vipers remain as long with equal ease in the stomach of their parent?"

On page 68, in treating of the venom of Vipers, he mentions the following case of a Horned-viper presented to Dr. Guyon in Algeria: "This reptile had been put into a bottle, which had since remained hermetically closed. It had been in there for six weeks, without food and without air, and looked quite dead, since it could not stir in the bottle, which it filled entirely. And yet, on opening the bottle, the

* OUR REPTILES. A plain and easy account of the Lizards, Snakes, Newts, Toads, Frogs, and Tortoises indigenous to Great Britain. By M. C. Cooke, author of "Rust, Smut, Mildew, and Mould," "A Plain and Easy Account of British Fungi," "Manual of Structural Botany," "Manual of Botanic Terms," etc., etc. With original figures of every species, and numerous wood-cuts. Published by Robert Hardwicke, London. 1865. 12mo. 200 pages, 11 plates, and numerous cuts.

We can heartily recommend the works of Mr. Cooke to our readers, as just the books that will interest and instruct all lovers of nature, and should be pleased to order any of them for our subscribers.—EDS.

doctor found the reptile perfectly sound, and saw it kill a large fowl instantaneously with its sting" [fangs].

On page 76, Mr. Cooke comes boldly to the question in point, and under the heading of *Does the Viper swallow its young?* gives several pages which we quote in full.

The belief has a firm hold in the minds of many, that, on the approach of danger, the young of the viper glide to their parent for protection, and that she opens her mouth, and, one by one, they pass down her throat, where they rest in security till the danger is past. To prove a negative is always a difficult task, but the effort to remove a prejudice must be even greater to be successful. Clergymen, naturalists, men of science and repute, in common with those who make no profession of learning, have combined in this belief, and to them we are indebted for many such accounts as the following: "Walking in an orchard near Tyneham House, in Dorsetshire, I came upon an old adder basking in the sun, with her young around her; she was lying on some grass that had been long cut, and had become smooth and bleached by exposure to the weather. Alarmed by my approach, I distinctly saw the young ones run down their mother's throat. At that time I had never heard of the controversy respecting the fact, otherwise I should have been more anxious to have killed the adder, to farther prove the case."* Nothing can well be more positive, clear, definite, and many would think *decisive*, than the foregoing; yet, so sceptical are some men on this subject, that they still dare to doubt whether there may not be some error in the observation. Let us advert to other witnesses, and evidence still more complete, and we do so with as earnest a desire for truth as the witnesses themselves, and to know that the debate is closed for ever.

J. H. Gurney, Esq., of Catton Hall, near Norwich, well known as an ornithologist, and especially for the splendid collection of Raptorial Birds in the Norwich Museum, which has been obtained chiefly through his instrumentality, in the year 1863 communicated to the *Zoölogist* the following instance, told to him by a person in whose accuracy he had the fullest reliance. "John Galley saw a viper at Swannington, in Norfolk, surrounded by several young ones; the parent reptile perceiving itself observed, opened its mouth, and one of the young ones immediately crept down its throat; a second followed, but after entering for about half its length, wiggled out again, as though unable to accomplish an entrance. Upon this Galley killed and opened the viper, and found in the gullet, immediately behind the jaws, the young one which he had seen enter, and close behind that a recently swallowed mouse. Galley was of opinion that the first young viper which entered was unable to pass the mouse, and that consequently there was not sufficient room for the second

* Rev. H. Bond, South Petherton, Somerset, in *Zoölogist*, p. 7278.

young one, which endeavoured unsuccessfully to follow in the wake of the first."*

To this we may add another instance corroborative, and yet more conclusive, on the faith of a clergyman with whose name and address we are furnished, and in whose testimony we have the greatest confidence. "Now, 'seeing is believing,' and I well remember having seen in my boyhood—some thirty years ago—an instance of the fact, the truth of which is doubted because resting merely on the testimony of unscientific country people. Now, I have no pretensions to science, but I vouch for the truth—above referred to—of having, in my boyhood—when out on a birds'-nesting expedition, in a southern county, with some three or four companions—come suddenly upon a viper sunning her young brood on an open grassy spot in a broad hedge-row: hedge-rows were common in those days. Immediately she saw us, she began to hiss, and away went the young, previously some feet from her, 'helter-skelter' towards their mother; rushed into her mouth—expanded to an immense width for so small a creature—and down her throat, one over the other, while you could say 'Jack Robinson.' The space where she was recreating was some twenty feet square, so that before she could beat to cover, we, boylike, being armed with sticks, had beaten her to death. This done, one of the party with his knife opened the body, and out came again the little ones, all of which we killed. I do not remember the exact number, but my impression is that it was not more than six or eight."† Another gentleman recently communicated to *Science-Gossip* the following occurrence:

"Some years since I was shooting in a wood, and came suddenly on a viper lying on a sunny bank. As soon as the viper caught sight of me, it began to hiss, and I distinctly saw several young ones, about three or four inches long, run up to the parent and vanish down its throat: and from the way in which the parent kept its mouth open, and the young ones glided into it, I should say they were accustomed to that sort of thing."‡

We must not forget that some time since the following occurrences were narrated in the *Zoölogist*, by the editor himself, and whilst they strengthen the evidence of the viper swallowing its young, further serve to establish the fact of *viviparous* reptiles being addicted to that habit. Both these illustrations refer to the "Scaly Lizard," which, like the viper, brings forth its young alive. "My late lamented friend William Christy, jun., found a fine specimen of the common Scaly Lizard with two young ones; taking an interest in everything relating to Natural History, he put them into a small pocket vasculum to bring home, but when he next opened the vasculum the young ones had disappeared, and the belly of the parent was greatly distended; he concluded she had devoured her own offspring. At night the vasculum was laid on a table, and the lizard was therefore at rest; in the morning the young ones had re-appeared, and the mother was as lean as at first."

* *The Zoölogist*, p. 8856. † *Science-Gossip*, p. 108. ‡ *Ibid.*, p. 180.

"Mr. Henry Doubleday, of Epping, supplies the following information: 'A person whose name is English, a good observer, and one, as it were brought up in natural history under Mr. Doubleday's tuition, once happened to set his foot on a lizard in the forest, and while the lizard was thus held down by his foot, he distinctly saw three young ones run out of her mouth; struck by such a phenomenon, he killed and opened the old one, and found two other young ones which had been injured when he trod on her.' In both these instances," Mr. Newman adds, "the narrators are of that class who do know what to observe, and how to observe it: and the facts, whatever explanation they may admit, are not to be dismissed as the result of imagination or mistaken observation."*

We must confess that our own incredulity has been so staggered of late by these and similar instances, that we are by no means disposed to deny, because we cannot fully comprehend, the mystery of the process. It is admitted by some physiologists, if not by all, that there is no sound physiological reason against such an occurrence; and, until we are convinced by better arguments than have hitherto been advanced, we are bound to admit that in "our inmost hearts" there lurks a belief that the maternal viper has a knack of swallowing its young. Whether our scientific friends consider us renegade from the true faith or not, we will at least be true to ourselves.

With this feeling of Mr. Cooke's we fully sympathize, and we believe the whole matter can be put at rest by any person, who, on observing a snake in the act of swallowing its young, will think to capture and place her in a box by herself and see if the young again issue from the mouth. Should any of our readers ever obtain this much desired proof, we trust they will at once communicate it to the NATURALIST, and, if possible, send the whole family to the Academy, that the mother may be induced, if possible, to gratify us with an exhibition of her care for her offspring.

There is one other matter of interest to be decided, and that is, taking it for granted that snakes *do* swallow their young, is it a habit common to all snakes, or only to certain species? In this country this habit has been, we believe, only attributed to the several species of Rattlesnakes (*Crotalus*), and to the Water-adder (*Tropidonotus sipedon*), while in Europe it is generally attributed to the Vipers (*Pelias*). The interest in this question is farther increased

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* *The Zoölogist*, p. 2269.

by the fact, that the Rattlesnake and the Vipers are ovo-viviparous; that is, their young are hatched from the eggs while still in the body of the parent, and come into the world perfectly formed. The Water-adder and the common Striped-snake are probably also ovo-viviparous, but of this we are not sure. The common snake of England, the representative of our Striped-snake, is supposed to be wholly an oviparous species. And our Striped-snake may be the same under natural circumstances, though one kept in a box gave birth to a number of living young, about the last of August; but this snake had been in confinement for a long time, and may have retained her eggs in the oviducts much longer than the natural period, owing to the want of a proper place in which to deposit them. All possible means were tried to induce this snake to take the young into her mouth but without success, though this may be accounted for by the supposition that the snake was so tame that she could not be easily frightened, or, if really an oviparous species, that it was not her habit.

We have never known that our Black-snake, Green-snake, Little Brown-snake, and other oviparous species, have ever been supposed to swallow their young. Neither have we seen any account of such an occurrence in the common snake of Europe.

There is little doubt but that many of the supposed instances of young snakes having been swallowed by the parent are owing solely to the fact that some species bring forth fully developed young; for the statement is often made by persons that they "know snakes swallow their young, for they have killed an old snake and found the young ones in her;" but, on being asked if they were sure the young snakes had ever been born, it was found that they had taken that for granted, supposing that all snakes laid eggs, and that hence the young found inside the mother must have been swallowed. This is mentioned to call attention to the care with which the examination of snakes found with

young ones should be made in order to be sure that the young were really in the alimentary canal and not in the oviducts. It is also of importance to ascertain if young snakes, after having been swallowed by the parent, ever enter the stomach or are confined to the space in the œsophagus above it. This can be discovered by cutting open the throat and following down to the stomach, which in most species is situated from about one third to one half the distance between the mouth and the termination of the alimentary canal, and can readily be determined by its thicker walls and more numerous folds on its inside, which are very marked when the stomach is not distended with food.

THE LAKES OF IOWA,—PAST AND PRESENT.

BY C. A. WHITE, M. D.

Lakes of Iowa! reiterates some New England reader, and, seeing no large bodies of water represented on the map of that Commonwealth, he really thinks ponds must be meant. Well, be it so, but the writer hereof is a western man, and in the West all collections of fresh water, whether large or small, are called lakes or lakelets. Perhaps, however, he has heard the stories of the "walled lakes" of Iowa, in which the wondrous handiwork of a departed race of men is described, consisting of walls of huge stones encircling the lakes like that of an artificial fish-pond, so raised as to prevent an overflow of water upon the adjacent low ground; sloping down to the water's edge with a pavement like a Mississippi levee; rounded and graded with earth upon the top, forming a good road upon which the Jehus of that departed race doubtless drove their elk or buffalo chariots in pursuit of pleasure or of their daily avocations; and the whole finished with a garniture of sage reflections upon the mutability of

human affairs. Such fantastic stories have been frequent in our newspapers for several years, rendering those modest little lakelets so famous that many pilgrimages have been made to their borders with the hope of finding something to aid in penetrating the mystery that shrouds the early human history of our continent.

It is such lakelets as these and their origin that will now in part engage our attention; and while showing the groundlessness of the stories referred to, we hope to present still more interesting and wonderful facts, because in the realm of Nature truth *is* stranger than fiction.

First, let us go back to their origin, for they originated from causes so definite that we are often able to comprehend them as clearly as if we saw them in operation; and the time of their formation in relation to other geological changes is as accurately determined as that of any other. Not only have the lakes had a definite origin, but, as we shall presently see, some of them have also had an end, and we know they once existed only by means of the records they have left in the earth they once covered. Hence the addendum to the above title,—past and present.

Lakes have doubtless existed upon the earth's surface in every geological age; but those of which we are speaking had their origin at a period really very remote when considered in relation to the historic era, but *very* recent when compared with the geological ages which preceded it.

At the close of the Glacial epoch the ice disappeared from the temperate zone, the present condition of the climate was established, and the continent assumed very nearly its present dimensions and form. The northern part of the Great Valley—it is to this region to which more especial reference is made—was not then marked by strong topographical features, for it was traversed by no ranges of mountains, nor by any rivers or streams. Shallow depressions only, which were filled with water from the rains and the melting ice, marked the surface. These were the primitive lakelets, and

existed before any definite streams were formed. Where the depressions were longitudinal, or connected in chains, they gave initial direction to the courses of the streams into which the surface-waters were gathered and carried away to the sea. These are the streams of to-day, and their ceaseless flow, aided by the rains and frosts of the unnumbered years that have passed since then, have worn their own channels down, not only through the incoherent drift, but often also through solid stratified rocks, the edges of which we see protruding from their valley slopes. Thus all the valleys of this region are valleys of erosion, and it is meteorological erosion alone that has given it its most prominent physical features.

As one stands upon the broad level prairies of Southern Iowa, and sweeps the well-defined ocean-like horizon with his level, he finds the bubble everywhere resting upon the cross-wire except where the distant dark line of forest foliage reveals the presence of a stream. Approaching this, the surface becomes undulating like the smooth rolling of a sea; but looking closely he will see that every depression leads into a still deeper one until the upper branches of the streams are reached, the surfaces of which are often more than one hundred and fifty feet below the prairie level from which he started; and the surfaces of the larger streams are sometimes a hundred feet deeper still. The higher prairie-surface of to-day is the same surface which was left by the retiring waters at the close of the Glacial epoch, and the time which has passed since then—that during which the valleys were formed—is called by geologists the Terrace epoch, because the oscillations of the streams from side to side of their valleys in the process of their erosion have left frequent terraces of material which successively constituted "flats" or "bottoms" bordering the streams, but which are now far above the reach of their highest floods. The Terrace epoch verges upon the present time, because the same streams still flow, and earthy matter is still carried by them to the sea, as rap-

idly perhaps as it ever was, although only occasionally sufficient in amount to muddy the water. Thus it will be seen how slowly the mightiest operations of Nature are performed: for this most recent of the geological changes has doubtless required a length of time so great that the human mind is incapable of comprehending it.

In Northern Iowa the prairie horizons are not so clearly defined as they are farther to the southward, and it was doubtless so at the beginning. The drift also contains more gravel and bowlders there, from the fact that nearly all of those materials originating still farther to the northward, their abundance diminished with the diminishing force of the glaciers to the southward. Numerous irregular rounded elevations or knobs mark the surface, between which are corresponding depressions; not produced however by erosion since the drift was deposited, as the river valleys were, but are, like the knobs, inequalities left by the glaciers.

Some of these depressions have become drained; some of them are still occupied by the lakelets, and some by peat marshes. Streams are numerous in Southern Iowa, and their valleys deep. Consequently the country is so well drained that all trace of the primitive lakelets is usually obliterated. But many of those streams have their rise in Northern Iowa, and many of those lakelets still exist there, because no accumulation of water beyond has sent a current across them to cut a channel for their outlet. Lake basins are sometimes hollowed very deeply into the earth, showing bold exposures of stratified or unstratified rocks upon their shores. But the lakelets of which we are speaking, had their origin in shallow depressions left in the surface of the drift alone at the close of the Glacial epoch. By the action of subsequent causes they, in certain regions, became "walled lakes;" for a majority of them are as worthy of that designation as those are of which the fanciful stories have been told. Nor are lakes of that character confined to Iowa alone, but are known also in Minnesota, Wisconsin, Michigan, and even in Connecti-

cut; yet all except two, one in Wright county, and the other in Sac county, Iowa, seem never to have been favored with the visits of an imaginative writer to tell fanciful stories of their associated remains of human handiwork.

It seemed necessary to make the foregoing statement of facts, and the geological principles which they involve, before attempting a description of the lakelets themselves, that such a description might thus be rendered more intelligible, and which is here given as the result of long-continued observation of sixteen such lakelets in Northern Iowa, including the two which have become noted as walled lakes.

They usually occupy an open prairie region. Sometimes small groves are near them, but trees are often entirely wanting, especially since the settlers mercilessly destroy them for fuel. They are from one to five miles across, but always very shallow, because the undulations within which they rest are very gentle. None of them are more than fifteen feet deep, and the majority are so shallow that they permit a luxuriant growth of wild rice and other aquatic plants from their bottoms over the whole, or a large part of their areas, among which water-fowl find shelter and abundant food, but which renders them rather uninteresting features of the landscape.

A true description of the so-called walls, but which we shall term embankments, will be best understood if given in connection with a description of their origin. When a pile of sand, obtained from the river shore, has been left by the workmen for a long time exposed to the washings of the rains, the gravel which it contains, and which at first is hardly visible, becomes in some cases even more conspicuous than the sand itself, because a part of the latter has been wasted, while the gravel remains. Thus it has been upon an extended scale with the drift, which, as before stated, is composed of bowlders, gravel, sand, clay, and soil, although little except the latter is usually seen upon the prairie surfaces. Sometimes the drift is more than a hundred feet

thick, and all the bowlders contained in the whole mass which has been swept out to form the valleys have gradually rolled down upon their slopes, and many of them into the streams. For this reason we usually find them more numerous upon surfaces that have suffered erosion than anywhere else. Again; the ceaseless dashing of a lakelet's waves stir up the finer material beneath its waters, to be carried away in the form of muddy water at the times of its overflow, leaving the bowlders and gravel strewn upon its bed; while they may not be seen at all upon the prairie surfaces around them.

This latter fact being misunderstood has led to the supposition, that, being absent upon those surfaces, they had been gathered up by human hands and carried to the shores to build the "walls" of; while the truth is, the embankments, as well as the presence of the materials of which they are composed, are due to natural causes alone, and their origin is wholly referrible to the periodic action of ice, aided in some degree by the force of the waves.

The water in the lakelets is usually very low in late autumn, and when winter comes it is sometimes frozen nearly to the bottom in their deepest parts, so that occasionally all the fish are killed by this means. The ice, of course, freezes fast to the bowlders as well as to whatever else may be within its reach, and the expansive power of from one to five miles of freezing water is exerted upon them in a direction from the centre towards the shores,—a power much more than sufficient to move the largest bowlders upon those gentle slopes.

The embankments are from two to six feet high, and from two to twenty feet across the top, and always separate a low piece of ground from the lake; because where the original shore is a little abrupt, and higher than the high-water level, no embankment is formed, but the bowlders are merely thrust against the shore with such force as to render it steep, and often thickly studded with them.

Meeting no such obstruction on a marshy side, the material thrust out accumulates just where the expansive force of the ice is spent. This process repeated year after year, from age to age, has cleared the bottom of the lakelets of their bowlders and other materials, and piled them up in circular ridges upon their shores; and these are the "walls" which have excited so much wonder. It has been observed that the embankments are heaviest on the sides opposite the prevailing winds. This may be accounted for, at least in part, by the fact that the ice being burdened with the material to which it has frozen fast, would thus be floated against those shores when the spring floods had raised the water of the lakes; and in part also by the farther fact that the dashing of the waves would be most constant against those shores.

Thus it will be seen that whatever was originally upon the bottom, whether bowlders, gravel, sand, or mud, has been carried to the shore, and we find the embankments composed of all these materials arranged in perfectly natural disorder. If bowlders were numerous, the embankment is largely composed of them. If sand prevailed, a broadly rounded embankment is formed, just such as we should expect from such material; and where a peat marsh extends out into the land, an embankment of turf is thrown up at the water's edge, which, being supported by living rootlets, is frequently high and very narrow. The latter are somewhat numerous, and are often called beaver-dams; but this is also a misconception, because beavers never attempt to dam still waters. They dam running streams to obtain ponds of still water. Thus we see that the same natural force placed the bowlders in the embankments that brought them down from their northern homes, namely, the expansive power of ice.

If its crust should remain perfectly stable long enough, the earth would become nearly a perfect sphere by the disintegration of its exposed substance, and the levelling force of gravitation. It is true that its inequalities of surface are

now very insignificant compared with the vastness of its bulk; but, in such a case, there would be no mountains, no islands, no continents. All would be an endless and shoreless sea. The erosion of the river valleys, and the consequent drainage of a majority of the primitive lakelets, may be regarded as the first steps in this levelling process, after the glaciers had ceased from the Great Valley; for its post-glacial geology seems to warrant no subdivision into epochs such as are made for other regions. Therefore the whole is here referred to the Terrace epoch. Long before this levelling process can approach completion, other elevations and depressions will be formed upon the changing surface. See, then, how small a part of such a result has been accomplished even by the erosion of the valleys of the great Mississippi and its branches. A part of the primitive lakelets, and a part of the original surface of the drift still remain almost unchanged since their formation. The prairies have still their ocean-like surfaces, and the greatest change the lakelets have undergone in that immense lapse of time is the formation of their insignificant embankments, if aught in nature may be called insignificant. Let us look a little to what has been accomplished by erosion in the Great Valley* during the Terrace epoch as before defined.

Along the courses of what are now the Mississippi and Missouri Rivers, large depressions formerly existed which formed lake-like expansions of those rivers. Thus after the Mississippi had made for itself a definite valley, but before it had cut its channel down to its present level through the rocky obstruction at the Keokuk rapids, that portion of it which borders a large part of the eastern side of Iowa was little else than a lake which averaged about five miles wide, and filled the space between what are now the bluffs that border each side of its broad flat valley.

*It will be observed that the word *valley* is used with two separate significations, one applied to the hydrographic basin drained by a certain principal stream and its tributaries, and the other to the depression occupied by any particular stream, and which its own waters have cut out of the general surface.

This is proven by the existence there of terraces composed of very fine sedimentary material such as could have been deposited only in comparatively still waters, and also by the existence in that sediment of shells which inhabit still waters only,—the same species which now inhabit fresh-water lakes. River shells, such as now exist in the river, are found on the sides of the bluffs near the rapids at a height of seventy feet above the present high-water mark; and since such beds of shells exist only at low-water mark when alive, upward of eighty feet must be estimated as the height of the river above its present level at the time they lived. It will be observed that river, and not lacustrine shells are found near the rapids. This is accounted for by the fact that the obstruction which caused them, being a flinty formation, and not so easily disintegrated as the other rocks are over which the river runs, has existed as such from its earliest history. Consequently the water there always had a considerable current, while farther to the northward there was too little current to produce a congenial habitat for those shells. The estimated eighty feet is doubtless only a part of the actual height from which the erosion of the Mississippi Valley has reached, because it now averages about two hundred feet deep from the general prairie surface. Thus we see that when that lake-like expansion existed in the Mississippi River, its valley had already been eroded to a considerable depth, and the Terrace epoch was well advanced. But on the other side of the State we have proof of the existence, in the early part of that epoch, of a lake which was larger and deeper than Lake Erie. This proof consists principally in the presence there of a peculiar lacustrine deposit extending at least from the Big Sioux to the mouth of the Kansas River, and from twenty to thirty miles on each side of the Missouri River, through which the latter has cut its present valley, in some places to a depth of more than two hundred feet before it reached the drift which was deposited there during the Glacial epoch. That mate-

rial is known to have been deposited in fresh water, because only fresh-water shells are found in it, and they are found in it from top to bottom. It is known to have been deposited in still water, because the same kinds of shells are now living in still water only, and because the whole deposit is a fine homogeneous material without sand, gravel, bowlders, or anything else, except what would have been deposited in a lake of *muddy* water.

It has been claimed by a few geologists that at the close of the Glacial epoch a shallow fresh-water lake occupied the whole hydrographic basin of the Mississippi, and that the fine soil and subsoil of the prairies and other lands of the whole region, as well as the peculiar deposit just referred to, are identical in their formation, and had their origin in one and the same broad lake. Upon this hypothesis some have accounted for the origin of the prairies and for the absence of trees upon them; but the fact is, prairies exist upon both these deposits, and it would require direct effort to keep all kinds of indigenous trees from encroaching upon the prairies if there were no annual fires.

It is not improbable that such a wide-spread sheet of fresh water did exist at that time, and that a large part of the sedimentary material that composes our soil and subsoil had such an origin. But that is widely different in physical characters from the deposit under discussion, which evidently had a different, as well as a subsequent origin. These circumstances seem to leave no room to doubt that a well-defined lake existed there after the continent had in great part become dry land, but before the great rivers had cut their valleys down to any considerable depth. The lake, although so large and deep, was doubtless filled with sediment to the general prairie level within a comparatively short time after the glaciers ceased, just as the sediment of the same river which then flowed into and from it, now speedily fills the reservoirs of the St. Louis Water-works, so that they must often be reëxcavated. Just as the same

river would now fill with the same kind of sediment any depression, however large, if such existed in its course.

The great northern lakes are not thus filled, because their tributary streams are pure; and their streams are pure because they flow over geological formations that are not easily disintegrated; while the main tributary of that ancient lake, the Missouri River, is even now one of the muddiest streams on the globe. In the earlier portion of the Terrace epoch it was, if possible, more so; for then as now, it gathered up its sediment from that broad region occupied by the friable rocks of the Tertiary and Mesozoic ages, stretching far away toward the Rocky Mountains, at that time strewn with the grindings fresh from those "mills of the gods"—the glaciers.

The formation of the basin in which the lake rested is known to have taken place during the Glacial epoch, because the drift, with its striated bowlders, now covers its bottom beneath the lacustrine deposit, and because the cutting out of the river valley has exposed, in a number of places, the stratified rocks which the drift rests upon, whose surfaces were scored and striated by the moving glaciers of that epoch. It is known that the filling of the lake with sediment occurred in the early part of the Terrace epoch, because it was filled up even with the prairie surfaces, which would not have been done if the Missouri River had first eroded its valley to any considerable depth below the lake. We know that the lake was so far filled with sediment before it was drained, that it was little else than a marsh, because the top of that deposit of sediment is now nearly even with the higher prairie surfaces, and because the river bluffs which it forms are as high as those formed of the usual materials, —the drift and stratified rocks.

The physical characters of this lacustrine deposit are so peculiar, that they attract the attention of every person who becomes acquainted with it, although a stranger might pass over the formation without observing more than its peculiar outline of bluffs. It is perfectly uniform in character and

color from top to bottom, and a hundred miles of distance show no more difference than a hundred feet. It is of a slightly yellowish ash-color, except where rendered darker by decaying vegetation, very fine, not sandy, and yet not adhesive. At the surface it makes excellent soil, and is just as fertile if obtained at a depth of two hundred feet. It is easily excavated by the spade alone, and yet it remains so unchangeable by the atmosphere and frost, that wells dug in it require to be walled only to a point just above the water-line, while the remainder stands so securely without support that the spade-marks remain upon it for many years. Road embankments upon the sides of excavations stand like a wall, showing the names of ambitious carvers long after an ordinary bank of earth would have disappeared. As that part of the valley of the Missouri River below the lake was deepened during the Terrace epoch by the natural process of erosion, the peculiar material which its own waters had previously deposited offered little obstruction to that process, but was readily swept out again as muddy water, and sent on its way to the sea. Thus no more of it was cut out than served to form the valley, which is from four to twelve miles wide, while the larger part remained, forming the bluffs, and extending far inland from the river. The tributary streams which at first emptied into the lake, now traverse its ancient bed of sediment to the river, and have cut down their own valleys to meet it. The sides of these valleys where they traverse that sedimentary deposit are steep like the river-bluffs, and the streams being smaller, their valleys are narrow and very deep. This is particularly true of all those Iowa streams that empty into the Missouri River above Council Bluffs, and they thus present great obstacles to the construction of lines of railway directly east and west through that State. For this reason, and for the purpose of connecting with the great Pacific Railway at Omaha, the more northern of those lines are diverging to the southward down the valleys of the streams, instead of crossing them, so

that passengers will pass dry-shod through the bed of that ancient lake, although many fathoms beneath the level at which its waters used to rest.

The peculiar outline of the bluffs along the Missouri River valley is one of the most interesting features of this remarkable deposit. As one views them in the distance, and in their nakedness, for they are often entirely destitute of trees, towering up from the level bottom-land, sometimes more than two hundred feet in height, so steep in some places that a man cannot climb them, he can hardly rid himself of the idea that they are supported by a frame-work of rocks as other bluffs are. Yet not a rock or pebble of any kind or size exists above their base of drift, except a few calcareous concretions which were formed from the limy water that now percolates through the whole mass. The form and arrangement of their numerous rounded prominences sometimes present views of impressive beauty as they stretch away in the distance, or form bold curves in the line of hills.

A few miles below the city of Council Bluffs, they present a full crescentic front to the westward, with the broad Missouri bottom stretching miles away from their base to the river. Their only vegetation here is a covering of wild grasses, and as the mound-like peaks and rounded ridges jut above each other, or diverge in various directions while they recede backwards and upwards to the higher lands, the setting sun throws strange and weird shadows across them, producing a scene quite in keeping with that wonderful history of the past of which they form a part.

REVIEWS.

THE AMERICAN BEAVER AND HIS WORKS.*—Mr. Morgan has, in this elaborate work, given us a thoroughly accurate and most entertaining account of an animal whose instincts and habits and economical value have attracted universal attention. The work is illustrated by lithographic plates from photographs of beaver-dams and their surroundings, taken with great pains in the wilderness on the south-west shore of Lake Superior. The frontispiece represents the beaver, and if actually taken from life is drawn in a remarkably ungraceful attitude, that of listening, which shows what a stiff and clumsy animal it must be on land.

A railroad to the iron region opened up "a beaver district more remarkable, perhaps, than any other of equal extent to be found in any part of North America," offering a rare opportunity for a careful study of this creature.

An anatomical chapter by Dr. W. W. Ely, and a geological account precedes the history of beaver-dams, lodges, burrows, canals, meadows, trails, and their means of subsistence, which are followed by chapters on the mode of trapping the beaver, and its psychology.

Besides the common brown beaver, there occasionally occur a black form and albinos. "In form the beaver is short between the fore and hind legs, head heavy and clumsy, and his motions are slow and awkward. He walks with a waddling gait, with his back slightly arched, with his body barely clearing the ground, and his tail dragging upon it;" in the water, however, it is very graceful. It swims chiefly by the webbed hind feet. The fore feet are very small, and, "as they are capable of a very considerable rotary movement, he is able to hold sticks and limbs of trees, and to handle them with great dexterity while cutting them, and also to carry mud and stones." As the beaver lives more often in burrows, his paws are armed with large powerful claws, of which there is an extra one on the second toe of each hind foot, which is peculiar to this animal. It uses its tail to assist variously in swimming and diving, to give an alarm by striking the surface of the water, giving a report that can be heard half a mile; and also as a trowel to "pack and compress mud and earth while constructing a lodge or dam, which he effects by heavy and repeated down strokes." "They pair, and, with their offspring, live in the family relation until the latter attain maturity, when they are forced to leave the parent lodge." But they do not live in villages, though two or more such families inhabit the same pond, and together keep the dam in proper repair. The beaver lives for twelve or fifteen years; carries its young from three to four months, bringing them forth usually in May, "and from two to five and sometimes six at a time."

* The American Beaver and his Works. By Lewis H. Morgan. Philadelphia, 1868, 8vo. pp. xi, 330. With plates and illustrations.

The author states that even the largest dams are the work of a single family carried on year after year, being "maintained for centuries" by constant repairs. Grass Lake dam, the largest one, perhaps, in North America, is fully described. It was two hundred and sixty feet and ten inches in length, and six feet and two inches in vertical height at the centre of the great curve in the middle of the stream, where it slopes thirteen feet on the lower face. It has been supposed to be an evidence of high intelligence that the beaver built its dam so as to curve up stream where the pressure of the water is the greatest, but the author candidly questions whether these curves are the result of accident or design.

Beaver-dams are usually sinuous, but curve either up or down stream, "a downward curve being much more common than the reverse in the large streams. The dam generally curves down in those streams that discharge the largest volume of water, when also the dams are shorter and lower than those on the smaller brooks."

The great dam on Grass Lake, so fully described, "contains upwards of seven thousand cubic feet of solid materials." This dam is also supplemented by an upper and a lower dam to break the force of the stream in freshets; the lower one setting the water back to the depth of twelve or fifteen inches in the great curve. Such structures are remarkable instances of prevision and engineering skill, reminding us of the intelligence shown by the Agricultural Ant of Texas, which, according to Dr. Lincecum, erects mounds on the "pavement" of its formicary in dry weather, in anticipation of the rainy season!

In excavating this artificial canal for transporting their wood by water to their lodges, beavers evince the most intelligence and "a complicated and extended process of reasoning," though the work is simpler than building a dam, and, like the latter, requires many years of continuous labor.

Like all close and patient observers of the habits of animals, the author believes that animals have a reason different only in degree from that of man. "When a beaver stands for a moment and looks upon his work, evidently to see whether it is right, and whether anything else is needed, he shows himself capable of holding his thoughts before his beaver mind; in other words, he is conscious of his own mental processes." "A canal is not absolutely necessary to beavers any more than such a work is to mankind; but it comes to both alike, as the result of progress in knowledge. A beaver canal could only be conceived by a lengthy and even complicated process of reasoning." In Missouri, where the river banks are steep the beaver constructs no canal, but "slides" which are unknown and not necessary in the Lake Superior region. "Contrary to the common opinion is there not some evidence of a progress in knowledge to be found in the beaver-canal and the beaver-slide? There was a time, undoubtedly, when the canal first came into use; and a time, consequently, when it was entirely unknown." The author hence argues a progression in knowledge, and hence improvement "from a lower to a higher

artificial state of life;" and the possession of a "free intelligence," far above the operation of a blind instinct, by which an animal is, according to Descartes' theory, a "mere machine." And yet the author concedes that the beaver is lower in intelligence than the carnivorous animals, the dog, fox, cats, etc. He ascribes memory, imagination, will, appetites, and passions and an intellect to dumb animals, and cites the case of Dr. Kane's lunatic dog as an evidence that these animals have a *mind to lose.*

TRANSACTIONS OF THE CHICAGO ACADEMY.* — We congratulate the Chicago Academy that this splendid volume, after vexatious delays caused by two fires, has at length appeared. It contains an article on Western Palæontology, by Professor J. H. McChesney, and Descriptions of Sub-carboniferous and Carboniferous Fossils, collected in the Iowa Geological Survey, by Dr. C. A. White and Mr. O. H. St. John. Dr. I. A. Lapham contributes a paper on the Climate of the Country bordering on the Great Lakes. Mr. F. B. Meek has an article on the Geology of the Valley of the McKenzie River, from notes and fossils collected by the late Robert Kennicott; and Dr. William Simpson contributes Illustrations of North American Birds in the Museum of the Academy, illustrated with beautiful colored plates, presented to the Academy by the liberality of several of its members and patrons. The Academy also publishes its octavo "Proceedings," and recently dedicated its new and spacious Museum. Science is carefully fostered in the West; the railroad companies provide the officers of the Academy with free passes and free freightage over their roads, and liberally extend other facilities and courtesies to naturalists engaged in scientific explorations.

POPULAR SCIENCE REVIEW, *January* (London). — M. Trécul has discovered the existence of minute vegetable organisms (*Amylobacteria*) within the starch-cells of *Helianthus tuberosus*, the Jerusalem artichoke. This has by him been regarded as a decided proof of the spontaneous generation of plants. The Review objects that vegetable forms of the lowest type may enter the tissues of animals. There is no more wonder in the fact of a Cholera-fungus in the blood of man than in a Amylobacterium in the starch-cell of a Helianthus tuberosus. — Professor Rolleston believes that the domestic cat of classical times was probably a Marten.—Herr. C. Claus, of Marburg, has published a paper to prove that the male of *Psyche helix*, a small moth allied to the Silk-worm moth exists. Our readers are aware that the case of *P. helix* was one of the "leading cases" in the history of Parthenogenesis, or development from asexual animals. — M. Donné, who has so long and ably supported the heterodox theory of spontaneous generation, has cried *peccavi*. He admitted that his latest researches, so far from supporting heterogeny, convince him of the accuracy of the views of his old opponent, M. Pasteur.

* Transactions of the Chicago Academy of Sciences. Vol. I, Part I. Royal 8vo. Chicago, 1867. With a map and eighteen lithographic plates and numerous wood-cuts. Price, $5.00 a part. (This merely covers the cost of publishing.)

Quarterly Journal of Science, *January* (London). — Signor Cocchi announces the discovery of a human skull in the lower beds of the Lower Post-pliocene strata in Italy. This lower portion consists of lacustrine clays of great thickness, with layers of peat towards its superior margin; it contains bones of the Mammoth (*Elephas primigenius*), *Cervus euryceros*, *Bison priscus*, and a species (probably new) of the Horse, *Equus*; it has also yielded stone implements and a human cranium, the latter from the plain of the Aretino. Whether this deposit be termed Lower Post-pliocene, or anything else, there seems little room for doubt that the skull was imbedded contemporaneously with the remains of the Mammoth, etc., and that Man lived in Italy contemporaneously with those animals.— The term *Gregarinæ* applied to the Chignon Fungus (see Naturalist, vol. 1, p. 379), is most inappropriate, as is admitted both by Drs. Fox and Beigel. It is the *Pleurococcus Beigelii*. The *Gregarinæ* are indubitably animals, and are internal parasites.

NATURAL HISTORY MISCELLANY.

BOTANY.

Vitality of Seeds. — Dr. Gray, in his "How Plants Grow," says, "The stories of seeds growing, which have been preserved for two or more thousand years with Egyptian mummies, are not to be believed." M. Figuier, in his work on "The Vegetable World," also cautions his readers against accepting certain statements of earlier writers to the effect that various seeds have been known to germinate after having been deposited in Roman and Celtic tombs nearly two thousand years. He then says, "We must not forget to speak of those wonderful seeds of wheat found in the tombs of ancient Egypt. It is now acknowledged that in this affair some one must have abused the confidence and credulity of the travellers. A variety of wheat called Mummy-wheat is common, it is true, among farmers; but no authentic fact justifies its name." From a paper recently drawn up by the Rev. Dr. Marks, of Meadville, Pa., at the request of a member of "The Natural History Society of the Meadville Theological School," I condense the following statement, using as far as possible the language of the original paper.

When Dr. Marks was in Thebes, in the winter of 1856, the Arabs were dragging forth from the mummy-pits great numbers of mummies. He saw them tear off the linen wrappings, in the folds of which were many pieces of papyrus, covered with Coptic characters. Very often in the mummies' hands were found grains of wheat, dura, flax, and the nut of the palm-tree. From the hand of one was thrown out the seed-cup of a

rose, which he picked up and brought away with him. This he subsequently gave, while residing at Quincy, Ill., to Mrs. Gov. Wood. On opening the seed-cup, she found several seeds, which she planted in a flower-pot, in her green-house. In the course of three weeks, two of these germinated, and, the next year, blossomed, producing a pink single rose, unlike any American variety with which they were acquainted. The estimated age of the mummy, from which the seed-cup was taken, was twenty-five hundred years.

Dr. Marks has in his possession some seeds of the *dura* (which he supposes to be the *corn* spoken of in the Book of Genesis), obtained by him from Egyptian mummies; but he has never tested their vitality. He testifies, however, to the fact of some dura seeds having been found in the hand of a mummy unrolled at Springfield, Ill., a few years since, which were planted by the Rev. Albert Hale, pastor of the First Presbyterian Church in that city, and which produced the same year several full-grown stalks, as large as Indian corn, and covered over with clusters of fruit which matured.

As throwing some light on the causes of this wonderful preservation of vitality, Dr. Marks states that the mummy-pits are perfectly dry, being situated from three to five hundred feet above the level of the Nile, and cut out of the rock of the mountain, which is a soft calcareous limestone. The pits are never either cold or damp.—GEO. L. CARY.

[If these seeds had been only thirty or forty years old, their prompt germination, although unlikely (for those who are in the habit of trying old seeds know how difficult it is to make any old seeds germinate), would be promptly believed upon this evidence. But marvels are to be credited only upon more rigid scrutiny. Scientific men will think it far more probable that some mistake has occurred in respect to the seeds, or deception by the Arabs, than that seeds 2,500 old actually grew.—A. G.]

BEES VS. FRUIT.—It is high time, we may add, that the *Peabody Academy of Science* were in full operation in Essex County, when one of its towns votes to "abate the nuisance" of bees, on the ground that they are injurious to fruit!

As to the nectar of the red clover being out of the reach of the honey-bee, it may be asked whether this be the case with the second crop, in which the flowers are generally rather smaller. The much better seeding of the second crop of red clover is thought to be owing to the greater abundance of bumble-bees in the latter part of summer.—A. GRAY.

THE SUN-DEW, A FLY-TRAP.—Mr. Millington has well described, in the April number, the phenomenon of fly-catching by the Sun-dew, and his wholly original observations show that he has perfectly comprehended these curious facts. That the *Drosera* catches flies in this way was, however, known to botanists and recorded in botanical works more than half a century ago. But the statement attracted little attention, and finally nearly died out of the books. It was re-discovered by Mr. Darwin, in England.

perhaps a dozen years ago, but I know not whether his observations are published, except by a brief allusion in the Gardeners' Chronicle. He found, as did Mr. Millington, that while the bristles will close upon a bit of raw meat, they are not sensitive to an inorganic body; yet that they are so to a bit of carbonate of ammonia. Mr. Darwin followed up this subject by some very interesting observations and experiments upon the Venus Fly-trap, *Dionæa*, which, with some recent ones made in this country, may soon be published. — A. GRAY.

FLOWERING OF HEPATICA TRILOBA. — March 12th, I found three *Hepaticas* in blossom, and on March 29th, I gathered quite a handful. — J. H. SEARS, *Danvers, Mass.*

ZOÖLOGY.

INSTANCES OF ALBINISM AMONG OUR BIRDS. — In a recent number of the NATURALIST, a correspondent mentions a "Singular Variety" of the Field Sparrow (*Spizella pusilla*). His specimen is an example of the partial albinism which is, perhaps, not so rare among birds as it is generally supposed to be. When we remember what an extremely small percentage of individuals of any species comes under observation, the wonder rather is, that so many albinos are found. In the course of a few seasons' collecting, I have met with the following instances of albinism, partial or complete.

Field Sparrow (*Spizella pusilla*). A specimen shot in the fall has the wings and tail mostly white, and all the upper parts patched here and there with white.

Western Snow-bird (*Junco Oregonus*). A specimen shot at Fort Whipple, Arizona, Dec. 12, 1864, has a large, somewhat circular, pure white spot on the throat, distinctly defined against the surrounding dark colors. The plumage is otherwise perfectly normal.

Blue bird (*Sialia sialis*). A curious specimen, with a triangular white spot on the back of the neck; otherwise perfectly normal in plumage. I have seen this species entirely snow-white, with (probably) pink eyes, and flesh-colored bill and feet.

Robin (*Turdus migratorius*). With a large white spot on each side of the head, formed by the enlargement and coalescence of the white spots which occur normally about the eyes. The robin also occurs in snow-white plumage.

Bank Swallow (*Cotyle riparia*). With the upper parts delicate pale silvery gray; the under parts pure white, as usual. This is the only instance I have met with of albinism in this bird.

Blue Yellow-backed Warbler (*Parula Americana*). This is, in some respects, the most curious example of partial albinism I have ever seen, occurring in a family of birds little liable to this abnormity. The entire plumage is mottled and patched with white, the natural colors appearing in the spaces between the white areas.

Yellow-rumped Warbler (*Dendroeca coronata*). All the slate and blackish colors are replaced by dull silvery gray.

The common Quail (*Ortyx Virginiana*) is occasionally found with all the tints so light, dull, and faded as to fairly be considered albinotic. There is a specimen in this condition in the Smithsonian Institution. Crows and Blackbirds seem, to judge from the frequency of the occurrence of albinos, to be particularly liable to this aberration in color. The expression, "a white blackbird" is hardly so paradoxical as it might seem; and indicates as well established a fact as that "blackberries are red when they are green."

The Black Guillemot (*Uria grylle*), and the Sea-dove (*Mergulus alle*) are both very obnoxious to albinism; and, in fact, each has been described in this condition as a distinct species. But the albinotic condition of the Black Guillemot must not be confounded with its normal winter plumage, which is nearly white. The albino has no black whatever about it; the eyes are pink, and the bill and feet flesh-colored.

The question of albinism among the large Gulls of the genus *Larus* possesses unusual interest. The study of this condition among these birds is more than a matter of simple curiosity; having important bearing upon the validity of at least one of our accredited American species (*L. Hutchinisii* Richardson). Numerous authors speak of a "pure-white Gull," and several specific names have been based upon such a condition of plumage. The bird referred to is about the size of, or rather smaller than the Burgomaster (*L. glaucus*). If it is really a valid species, it would constitute the only known exception to the rule, that all the true *Lari* have the back and wings darker than the under parts.

The Philadelphia Academy has a fine albino Giant Petrel (*Ossifraga gigantea*). This is pure white, patched here and there with isolated blackish feathers. In the Smithsonian Institution there is a perfect albino Red-throated Diver (*Colymbus septentrionalis*). It is nearly snow-white, with pink eyes and flesh-colored bill and feet.

The opposite of albinism — *Melanism* — is an extremely rare condition. At this moment I can recall but a single instance of its occurrence. This is the Black Guillemot, which is occasionally found without a trace of white upon or under the wings. In this state it has been described as a distinct species (*Uria "unicolor"*). — Dr. Elliott Coues, U. S. A.

Return of the Birds. — The following birds, which left for their southern quarters about November last, returned to the vicinity of Danvers, Mass., in numbers, at the dates given:

Wild Geese passed to the northward February 26; Black-ducks, Robins, Red-shouldered Hawks, Blue-jays arrived March 2; Cedar-birds, Gold-finches, Lesser Red-poll Linnets, March 4; Star-breasted Larks, Woodcocks, March 8; Golden-winged Woodpeckers, Purple Finches, Bluebirds, March 12; Red-winged Blackbirds, Swamp Sparrows, Yellow-winged Sparrows, March 15; Common Pewees, Marsh Hawks, March 25; Wood-ducks, Crow Blackbirds, March 26; White-bellied Swallows (four specimens), March 27. — J. H. Sears, *Danvers*.

GEOLOGY.

Fossil Insects.—In Mr. Scudder's paper in the February number, allusion was made to a fossil lace-winged insect which appeared to have a stridulating organ at the base of the wing, like that of crickets and some grasshoppers. We give here a figure (Fig. 1) of this wing, called by Mr. Scudder *Xenoneura antiquorum*. We have also copied the figure (Fig. 2) of the so-called caterpillar (*Palæocampa anthrax*), which Messrs. Meek and Worthen have described in the Report of the Geology of Illinois. Mr. Scudder believes it to be a worm, although, in many external features, it strongly resembles the woolly caterpillars. Messrs. Meek and Worthen, who describe and figure this fossil in the Report of the Geological Survey of Illinois, vol. 2, Palæontology, 1866, state that "the specimen is not in a condition to show the head or feet; yet we are strongly inclined to believe from its form, and peculiar regularly arranged bundles of hairs, that it is a *Caterpillar*. If we are right in this suggestion, its discovery is certainly an interesting one, as it would present an evidence of the existence of *Lepidopterous* Insects, at a much earlier period in our world's history than has hitherto been suspected." It was found near the base of the Coal-measures, Morris, Illinois.

Fig. 1.

Fig. 2.

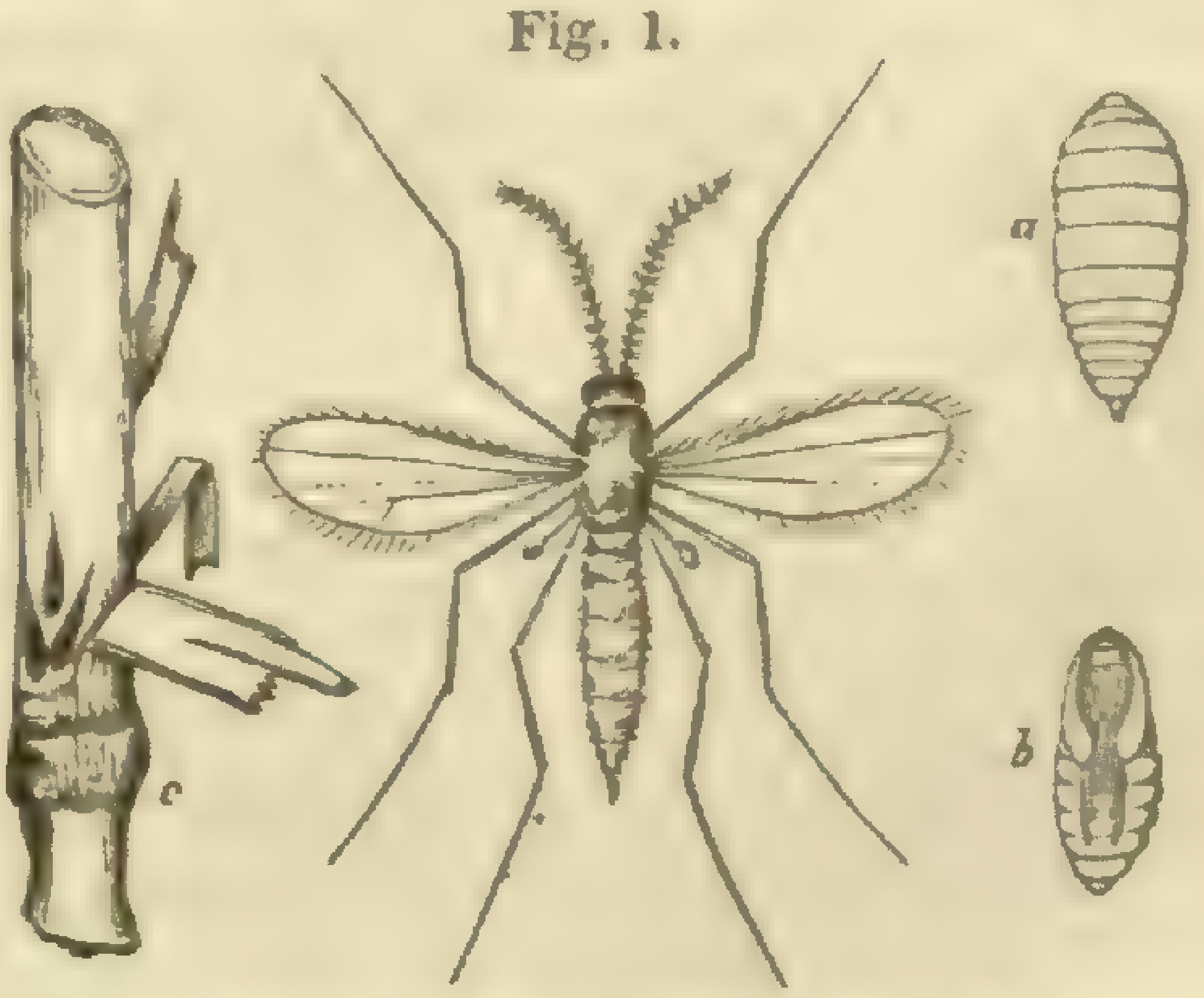
ENTOMOLOGICAL CALENDAR.

It should be remembered, that, unless otherwise stated, the dates given in the Calendars apply to the Northern States, especially New England, the same species appearing earlier southward.

Among the injurious hymenoptera, which abound late in this month, is the Rose Saw-fly (*Selandria rosæ*) and *S. cerasi*. The eggs are then laid, and the last of June, or early in July, the slug-like larvæ mature, and the perfect insects fly in July. Various Gall-flies now lay their eggs in the buds, leaves, and stems of oaks, maples, raspberries, and blueberry and other plants.

Dipterous Gall-flies are now laying their eggs in cereals. The Hessian-fly (*Cecidomyia destructor*, Fig. 1) has two broods, the fly appearing both in spring and autumn. The fly lays

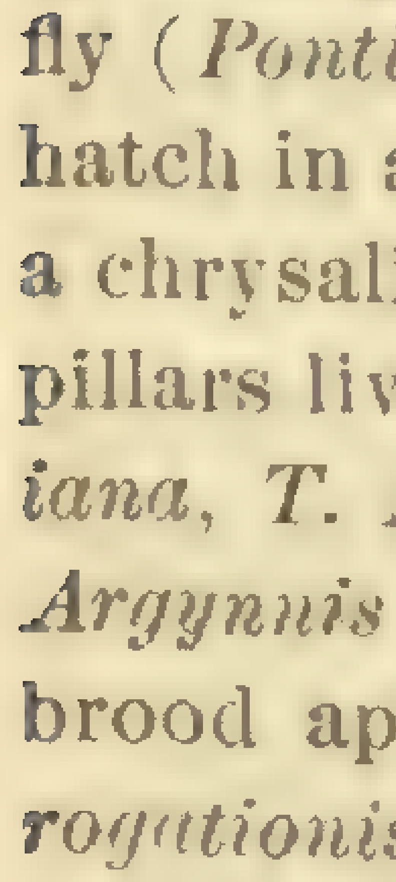
Fig. 1.



twenty or thirty eggs in a crease in the leaf of the young plant. In about four days, in warm weather, they hatch, and the pale-red larvæ "crawl down the leaf, working their way in between it and the main stalk, passing downward till they come to a joint, just above which they remain, a little below the surface of the ground, with the head towards the root of the plant. Here they imbibe the sap by suction alone, and, by the simple pressure of their bodies, become imbedded in the side of the stem. Two or three larvæ thus imbedded serve to weaken the plant, and cause it to wither and die. The second brood of larvæ remains through the winter in the flax-seed, or *puparium*. By turning the stubble with the plough in the autumn and early spring, its puparium may be destroyed, and thus its ravages may be checked. (Fig. 1 represents the female, which is about one-fourth as large as a mosquito: *a*, the larva; *b*, the pupa; and *c* represents the joint near the ground where the maggots live.) The same may be said of the Wheat-midge (*Cecidomyia tritici*), which attacks the wheat in the ear, and which transforms an inch deep beneath the surface.

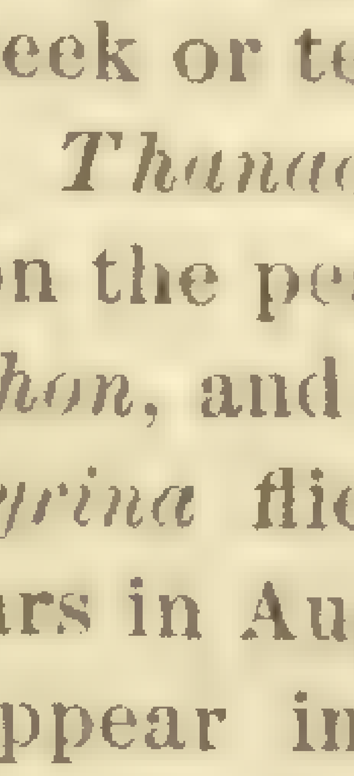
Among the butterflies which appear this month are the Turnip-butterfly (*Pontia oleracea*), which lays its eggs the last of the month. The eggs hatch in a week or ten days, and in about two weeks the larva changes to a chrysalis. *Thanaos juvenalis* and *T. Brizo* fly late in May. The caterpillars live on the pea and other papilionaceous plants. *Thecla Auburniana*, *T. Niphon*, and other species fly in dry sunny fields, some in April. *Argynnis Myrina* flies from the last of May through June, and a second brood appears in August and September. *Vanessa J-album* and *V. interrogationis* appear in May, and again in August and September. The caterpillars of the latter species live on the elm, lime, and hop-vine. *Grapta comma* also feeds on the hop. *Alypia 8-maculata* flies at this time, and in August its larva feeds on the grape. *Sphinx gordius*, *S. Carolina*, and other *Sphinges* and *Sesia* (the Clear-winged Moth), appear the last of May. *Arctia Arge*, *A. virgo*, *A. phalerata*, and other species, fly from the last of May through the summer. *Hyphantria textor*, the Fall-weaver, is found in May and June. The moth of the Salt-marsh Caterpillar appears at this time, and various Cut-worms (*Agrotis*) abound, hiding in the daytime under stones and sticks, etc., while various Tineids and Tortrices, or Leaf-rolling Caterpillars, begin to devour tender leaves and buds and opening blossoms of flowers and fruit trees.

Fig. 2 *b*.



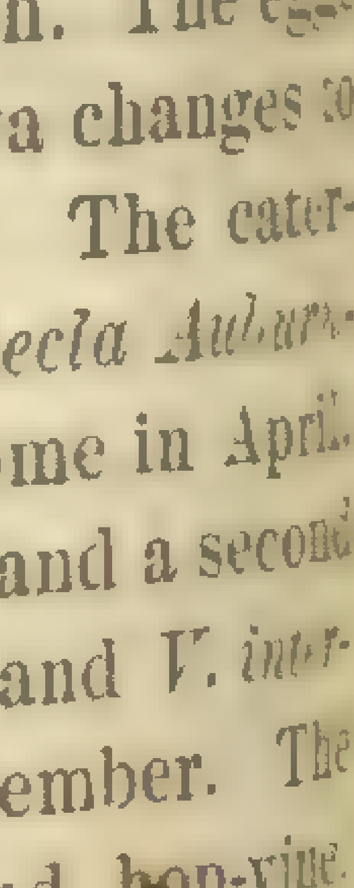
b

Fig. 2 *a*.



a

Fig. 2.



The White-pine Weevil (*Pissodes strobi*, Fig. 2 *a*, larva; Fig. 2 *b*, pupa; and Fig. 2, beetle) flies about in warm days. We have found its burrows winding irregularly over the inner surface of the bark and leading into the sap-wood. Each cell, in which it hybernates, in the middle of March, contains the yellowish-white

footless grub. Early in April it changes to a pupa, and a month after the beetle appears, and in a few days deposits its egg under the bark of old pine trees. It also oviposits in the terminal shoots of pine saplings, dwarfing and permanently deforming the tree. Associated with this weevil we found the smaller, rounder, more cylindrical, whitish grubs of the *Hylurgus terebrans* (Fig. 3), which mines the inner layers of the bark, slightly grooving the sapwood. Later in April it pupates, and its habits accord in general with those of *Pissodes strobi*. Another Pine-weevil (*Hylobius pales*, Fig. 4) also abounds at this time.

Fig. 3.

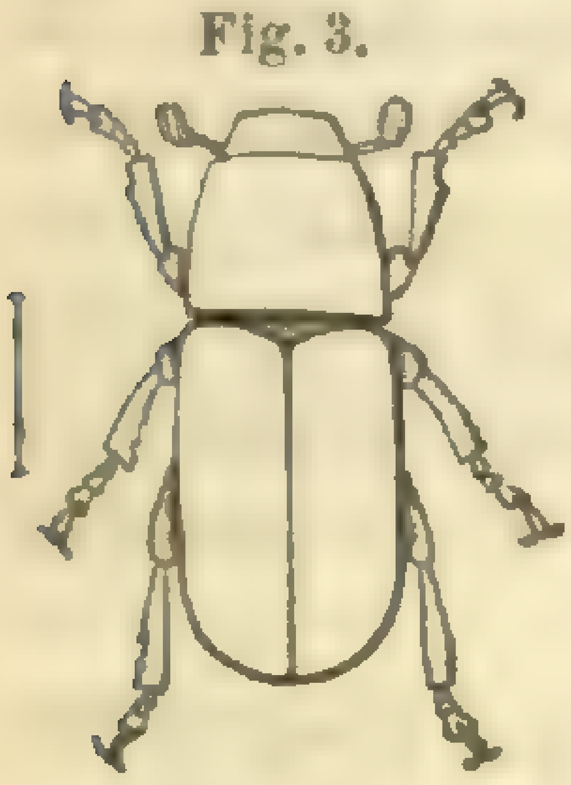
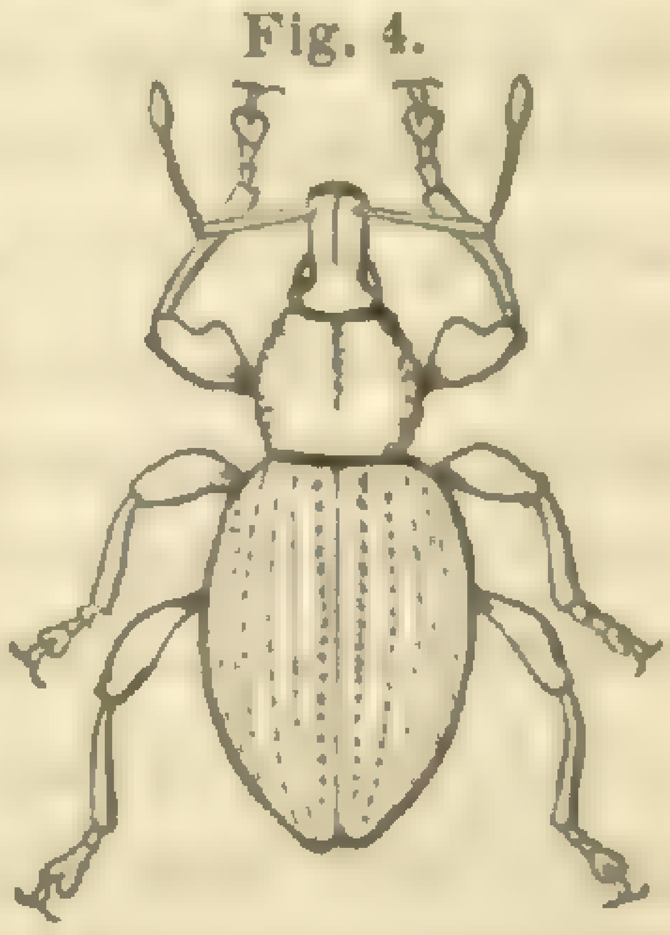


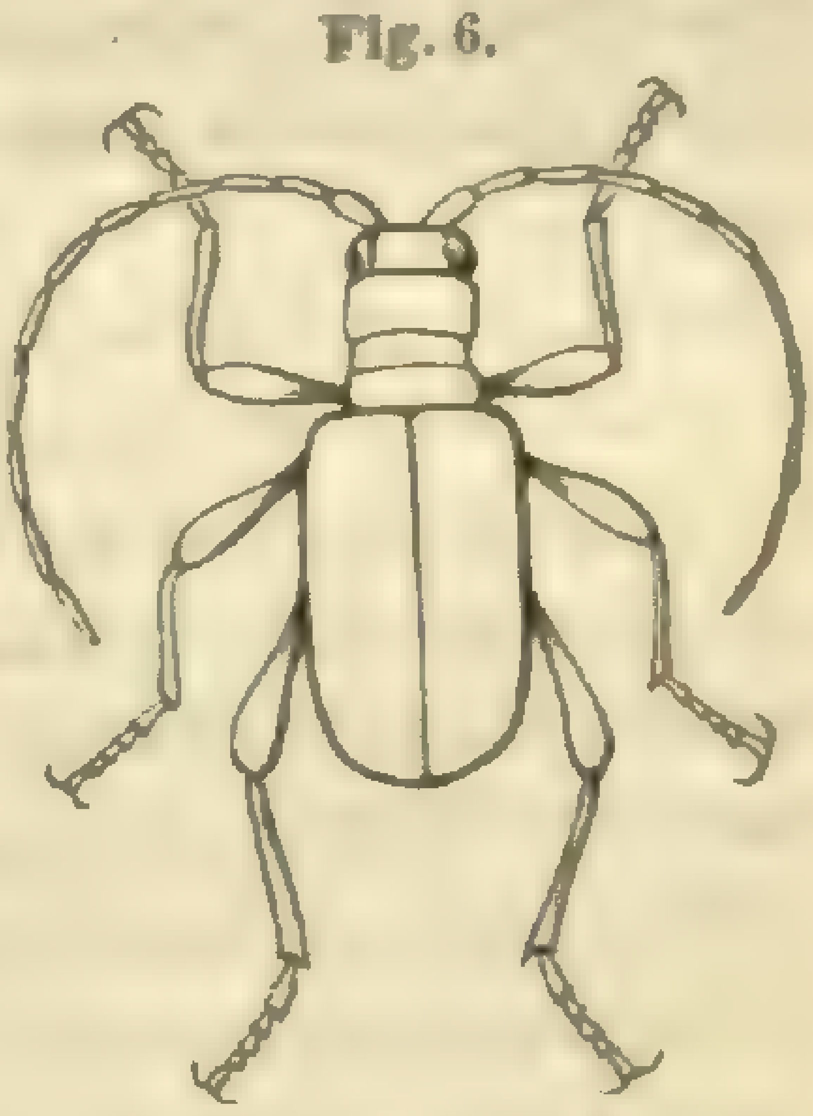
Fig. 4.



Cylindrical bark-borers, which are little round weevil-like beetles, are now flying about fruit-trees, to lay their eggs in the bark. Associated with the *Pissodes*, we found in April the galleries of *Tomicus pini*, branching out from a common centre. They are filled up with fine sawdust, and, according to Dr. Fitch, are notched in the sides "in which the eggs have been placed, where they would remain undisturbed by the beetle as it crawled backwards and forth through the gallery." These little beetles have not the long snout of the weevils, hence they cannot bore through the outer bark, but enter into the burrows made the preceding year, and distribute the eggs along the side (*Fitch*). Another *Tomicus*, more dangerous than the preceding, feeds exclusively in the sap-wood, running solitary galleries for a distance of two inches towards the centre of the tree. We figure *Tomicus xylographus* Say (Fig. 5). It is the most formidable enemy to the white pine in the North, and the yellow pine in the South that we have. It also flies in May. *Ptinus fur* (Fig. 6) is now found in out-houses, and is destructive to cloth, furs, etc., resembling the Larder-beetle (*Dermestes*) in its habits. It is fourteen-hundredths of an inch in length.

Fig. 5.

Fig. 6.



PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Academy of Natural Sciences. *Philadelphia, Oct.* 1, 1867.—Dr. Hays exhibited a fine specimen of Malachite; he also exhibited several specimens of hair from Albino negroes. Dr. Leidy spoke of the white Albino, and mentioned that the term "wool" was a misnomer as applied

to the hair of the negro; the differences between the races being those pertaining to the form of the shaft.

Oct. 15th.—Dr. E. Coues, U. S. A., presented a paper entitled, "Notes on a Collection of Mammals from Arizona." Professor Holmes, of Charleston, exhibited specimens of fossil remains of extinct and recent animals, accompanied by bones of man, with pottery, stone arrow-heads and hatchets from the postpliocene strata. He also called attention to the geology of the Charleston basin. Professor Leidy made some remarks in continuation of the subject; also noticed cases where the soft tissues of extinct animals have been preserved.

Oct. 22d.—Professor Wood presented some remarks on a fresh-water alga from the thermal springs in Mono county, California, which was said to grow in water having a temperature of from 120° to 136° F.

A paper was read entitled, "Notes on a Collection of Californian Myriapoda, with the description of a new *Lithobius* from Illinois," by Horatio C. Wood, jr.

Oct. 29th.—Mr. Lyman exhibited a map of the Pennsylvania coal regions, accompanied by remarks on the conglomerate formation of Sullivan county; he also called attention to the bending of a limestone post by its own weight, the specimen now being in the collection of the Academy.

Nov. 5th.—Dr. Leidy directed the attention of the members to a specimen of a fossil Peccary, *Dicotylus nasutus* Leidy. Professor Cope exhibited teeth of a new Cretacean, *Squalodon mento* Cope; specimens of the jaw of the *Squalodon atlanticus* Cope; also many bones of a new whale, which was named *Megaptera brachychira* Cope, with other fossils from the Miocene formation of Charles county, Maryland.

Nov. 12th.—Professor Cope read a paper entitled, "An addition to the Vertebrate fauna of the Miocene period of the United States." Dr Leidy read a letter from Professor Hayden, describing the Lignite beds of Laramy plains. Professor Cope spoke of the formation of natural coke which he had observed in Eastern Virginia. Dr. LeConte made remarks, illustrated by specimens, upon the tertiary coal-beds of New Mexico in the vicinity of the Rocky Mountains, and the Cretaceous coal-beds of the Rio Grande valleys. Both regions were regarded by him as capable of supplying abundant fuel for railroad, metallurgic, and manufacturing purposes. He also mentions beds in the vicinity of Denver of great thickness, from eleven to sixteen feet, free from impurities.

BOSTON SOCIETY OF NATURAL HISTORY. *Oct.* 16, 1867.—Prof. Agassiz remarked upon the antiquity of man. He said that fifty years ago both the learned and unlearned believed they possessed a trustworthy chronology of human history. Historians struck the first blow at this assumption by their researches into the successive dynasties which had ruled over Egypt. Their lead was quickly followed in the different departments of science, until now we are forced to cast aside the ancient beliefs and construct our chronology from a new and independent basis.

Twelve years ago, Ferdinand Keller, of Zurich, by his examination of the lake deposits of Switzerland, brought to light proofs of the existence of races of men with new characters of civilization. These discoveries astonished the world, and have since given rise to a new science, new societies, and new museums. Humanity is now connected with geological phenomena.

Formerly the presence of such large mammals as the Elephas primigenius, Rhinoceros tichorinus, Bos primigenius and Ursus spelaeus, was considered the dividing line between geological and human history,—now the extensive researches of such able naturalists as Lartet, Von Baer, Rütimeyer, and Brandt, have proved that these quadrupeds were once contemporaneous with man. The question before us is whether we can establish a successive chronology of events since the appearance of these animals upon the earth. Brandt has attempted to show that they were living within the historical period, and has argued therefrom that the native cattle of Europe were developed from the Bos primigenius. The argument for their recent extinction is drawn from documents hitherto partly unknown, because written in the Sclavonic tongue; these represent the existence of Bos primigenius in the forests of Lithuania and Poland up to the 11th and 13th centuries. The presence of Cervus megaceros in the marshes of Europe up to the 14th century is also made probable.

There is no doubt that the fauna of the diluvial deposits and of the European caves consisted of animals, some of which, at least, had a circumpolar geographical distribution, and that the southern limits of animals now living in the polar regions was once much greater than now; remains of the reindeer have been found all through France to the Pyrenees and in Southern Germany. We find that these mammals had intimate relations with the ice period, and it becomes necessary for us to investigate the extent of the ice-fields at the time when the glacial period was at its height. Professor Agassiz believed that the changes in extent which our ice-fields have undergone during successive periods, would furnish us with data for our chronology. In America, the ice-fields, at the time of their greatest extension with indefinite limits, reached the 32d degree of north latitude. In Europe they extended as far as the plains of Lombardy. Subsequent to this came a limited glacial period, in which the Southern and Middle States were freed from glaciers, but from Maine westerly the country was still ice-bound. During a third period the ice retreated to the northern shores of Lake Superior and the slopes of Mt. Katahdin, while in a fourth period, the one before the present, the continent was clothed with vegetation up to the hilly parts of Canada.

In answer to the question whether we had any means of connecting chronology with these facts, it might be stated that none of the cave animals or the large mammals which have been mentioned, have been proved to exist prior to the time of the greatest extent of the ice-fields, and, as it can no longer be doubted that man lived contemporaneously

with these animals, he believed that, with the waning of the ice-period, began the era of primeval man. In the successive epochs of the ice, indicated by the retreating ice, we have a *relative* chronology; when we ask for more specific statements of age, we find ourselves at once at a loss for an answer. Some indications might be seen in the abrasions of rocks of unequal hardness, and instances were cited in illustration of this.

In the course of the discussion which followed these remarks, Professor Agassiz said he hoped for great results from the investigations now undertaking in our own country, and believed that marks of the reindeer would yet be found in the Carolinas.

CORRESPONDENCE.

J. H. F., New York.—There is unfortunately no complete work on American Cryptogamic Botany. For works on Lichens, however, see the NATURALIST, Vol. I, p. 326. You will find the English works of Mr. Cooke, noticed in this number, very useful.

F. W. W., Concord, Mass.—There is no complete American work on Taxidermy. See, however, NATURALIST, Vol. I, p. 160, 321.

O. F., Needham Plain, Mass.—For works on American Entomology, see NATURALIST, Vol. I, p. 160, 441, and the last number. Subscriptions to "The Guide to the Study of Insects," which will be published in the autumn, may be sent to us.

L. A. R., Bucks, Ohio.—The specimen you inclose is a fossil gigantic Club-moss, *Lepidodendron*, which occurs abundantly in the shale inclosing coal-beds. Specimens from your region would be very acceptable. The Kangaroo Mouse you speak of is the *Jaculus Hudsonicus*, an animal well known as inhabiting nearly all the United States. The species of *Dipodomys*, to which Dr. Coues refers in his papers in the NATURALIST, as "Kangaroo Rats and Mice," are not known to occur east of the Mississippi.

N. T. T., Bethel, Me.—The substance to which you refer is the fresh-water Sponge (*Spongilla fluviatilis*). It occurs commonly in the ponds and sluggish brooks and rivers of Maine, and southward.

BOOKS RECEIVED.

The American Beaver and his Works. By Lewis H. Morgan. 8vo. Philadelphia, 1868. J. B. Lippincott & Co.

An Address on the Propriety of continuing the State Geological Survey of California, delivered before the Legislature at Sacramento, Jan. 30, 1868; to which are appended the letters relative to the Progress of the Geological Survey, etc., etc. By Professor J. D. Whitney. San Francisco, 1868. 8vo. pp. 23, 14, 15, 14.

Papers from "The American Beaver." By W. W. Ely. Philadelphia, 1868. J. B. Lippincott & Co. 8vo. pp. 46—77, 287—306.

The Field. March 7, 14, 21. London.

Cosmos. February 15, March 7. Paris.

American Bee Journal. April. Washington.

Notes on a Collection of Mammals from Arizona. By Elliott Coues, M. D., U. S. A. 8vo. pp. 4.

THE

AMERICAN NATURALIST.

Vol. II.—JUNE, 1868.—No. 4.

THE WARBLERS.

BY T. MARTIN TRIPPE.

OF all the various tribes of the feathered race that pour into the Northern and Middle States every spring, there is not one that will compare in beauty of plumage, and exquisiteness of form, with the family of the Warblers (*Sylvicolidæ*). Combining all that we admire in birds, and visiting us only in the most delightful season of the year, it is no wonder that they have been so much praised and admired. And yet they are very imperfectly known; even the specific rank of some of them seems scarcely to be established; while the breeding habits of many are as little known now, as they were in the days of Audubon and Wilson. Of late years, however, much has been accomplished in this direction; and, before long, we may hope to become as well acquainted with all of them, even the rarest, as we now are with the common yellow warbler.

Although some of the warblers are undoubtedly very rare, their general scarcity has been much exaggerated. That this should have been so, fifty years ago, is not surprising, when we consider the extremely short period during which most of them are found with us, sometimes not exceeding two or three days. In some instances, I have known a particular

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species to be extremely abundant during a single forenoon, while scarcely a single individual was to be seen during the rest of the spring, so quickly do they come and go. But that this should still be the case; that errors, which were made, perhaps unavoidably, by Audubon and Wilson, should still be perpetuated, is a matter of surprise and regret. Some species are much more abundant now than they were in the days of the older ornithologists, and some probably scarcer. Thus, both Audubon and Wilson mention the chestnut-sided warbler as one of the rarest of all, whereas it is now very abundant. Another general error was, in stating that they all withdrew to the far north to breed. There are, probably, very few of the species that enter the New England States that will not be found to raise their young in some part of its territory, large portions of which have not as yet been scientifically explored. Little attention, likewise, seems to have been paid to their notes and songs; and many, even, who are entitled to be ranked among the highest of our songsters, have been considered as destitute of musical ability altogether. The warblers have always been favorites of mine, and I have paid much attention to their habits and notes, particularly the latter. In the following brief sketch it is my intention to give a short account of each of the members of this interesting family, and to notice, more especially, such particulars as are not generally known, in regard to their songs, as have fallen under my observations.

The Pine-creeping Warbler (*Dendroica pinus*) is the first of the family to visit us in the spring, and arrives, in my locality in the latitude of New York, about the first of April. I have never known it to be very abundant, though it is seldom scarce. It affects, principally, the evergreen woods, but is often met with in other places. Its song, or rather note, for it can scarcely be said to have a song, is a rapid chatter, quite different from that of any other warbler, though it bears some resemblance to that of the *Myiodioctes pusillus*.

Soon after the pine-warbler has arrived, generally not more than four or five days, the Yellow Red-polled Warbler (*D. palmarum*) makes his appearance. Not very familiar, and yet not shy, they betake themselves to the deciduous woods, where, in numerous companies or small parties, they spend a couple of weeks, and then pursue their journey north. I have never heard them utter any other notes than a sharp "chuck," and a low chirp, which seems to be common to all the family, and can scarcely be distinguished in the different species. Unlike the other members of the particular subdivision of the family to which they belong, the Wood-warblers (*Sylvicoleæ*), they often descend to the ground, where they run about with as much agility as the Maryland yellow-throat. Another peculiarity which characterizes them is the habit they have of jerking their tails, in the same way as the pewee, though they do not do it nearly so often as that bird does. In October, they return in large numbers, dwelling now in the open fields and woods indifferently. They are the last of their tribe to leave us in the fall.

The Yellow-crowned Warbler (*D. coronata*) arrives about the time that the preceding species is leaving us, from the fifteenth to the twentieth of April. This is one of the most abundant and familiar of the class. It has a very sweet song, or warble, which it utters at short intervals in the early morning; its habits are too well known to require any farther notice.

Another bird of this family, differing in name as well as in general appearance from its associates, is the Black and White Creeper (*Mniotilta varia*), which, although a creeper by name, is a true warbler. It arrives about the twentieth of April, and although most of them pass farther north to breed, many spend the summer with us. Its breeding habits are well known; and, from various causes, it is one of the most favorite of the cow-blackbird's adopted nurses. I once found a nest of this bird with eight eggs in it, *five* of which were those of the cow-bird, and the other three her own.

There was much dispute among ornithologists some time ago as to whether the cow-bird ever laid more than one egg in the same nest. It was finally admitted that there were sometimes two placed in the same nest, but that one of these usually proved abortive; the five eggs that I found, however, were all sound, and had, apparently, been hatching for some days. Professor Baird, of the Smithsonian Institution, informed me, that, in company with Dr. Brewer, he found *three* eggs in a nest of the creeper, and that they considered it a very extraordinary circumstance. This bird is so well known, that it is scarcely necessary to speak of its notes, of which it possesses quite a variety. Its most frequent note, in spring, is a very fine, almost shrill song; but besides this, it sometimes, though rarely, gives utterance to a soft, liquid warble, quite like that of the redstart.

It is, perhaps, superfluous to speak of the Yellow Warbler (*D. æstiva*). This, as is well known, is the commonest and most familiar of all its family; and, spending the spring and summer with us, all its habits have long been known. I cannot but think, however, that sufficient justice has not been done to its song. Some authors even seem to be ignorant of the fact that it has a song at all, only giving it credit for its rather harsh, but characteristic spring note. It has, however, a true *sylvicoline* warble, which is sufficiently pleasant in itself, but derives additional interest from its being heard late in summer, long after all other birds, except the vireos, have ceased to sing. During the latter part of July, and all through August, the yellow warbler may be heard singing in the early morning, or in the twilight: and his sweet, liquid notes, pleasing as they always were, but which were scarcely noticed at all in May and June, in the concert of finer and louder voices, now sound doubly sweet amid the silence that reigns among the feathered choir.

The Black-throated Blue Warbler (*D. Canadensis*) arrives about the first week in May, and takes up his quarters in the low and swampy woodlands, where he finds his insect prey

abundant. The females arrive some time after their mates, and stay later; indeed, this seems to be the case with all the warblers. They stay during the whole month, remaining longer than almost any other species. On their first appearance they have no note but a simple chirp, but just before they leave us, the males have a singular drawling song of four or five notes. They pass here again in the fall on their southern migration about the first of October, and are both at this time and in the spring quite abundant.

The Black-throated Green Warbler (*D. virens*). This species, rarer than the former, though still not at all scarce, arrives about the same time. It far excels the former species in its song, which is varied, sweet, and not inferior to that of any of the *Sylvicoleæ*. In autumn, they come down to us from the north along with the black-throated blue warblers, or else a little earlier, and, after remaining a short time, move off to the south.

The Chestnut-sided Warbler (*D. Pennsylvanica*) is one of the most beautiful members of its class. It was, if we may trust the accounts given to us by Audubon and Wilson, a rare species fifty years ago; now, however, it is one of our commonest warblers. In some seasons it is excessively abundant, at others not as much so; but it is never very scarce. Its stay with us in the spring is usually very short, the main body not remaining more than two or three days. While on its spring visit it has, occasionally, a very pleasant song, which it utters at short intervals, in the early morning.

Somewhat resembling the chestnut-sided warbler in its coloring, but very different in its habits, is the Bay-breasted Warbler (*D. castanea*). It is one of the last to arrive, and, owing to the fact that by that time the foliage is pretty dense, and that it makes but a short stay, it is not very often seen. It is not quite so active as the other warblers, and keeps more on the lower boughs, seldom ascending to the tops of the trees. Early in the fall, about the middle of

September, it returns, and, associated with the black-polled warblers in large companies, haunts the groves and woods, being now more familiar than in the spring, and far more abundant. The young are totally different in their colors from the adults, and so closely resemble the young of the black-polled warbler, that it is often very difficult to distinguish them apart. I have never heard their spring love-notes; in fall, they have a faint chirp.

The Connecticut Warbler (*Oporornis agilis*) is one of the scarcest of the family. There are some peculiarities about the habits of this bird that deserve attention. Although excessively rare in spring, perhaps more so than any other species, it is, in autumn, quite often seen, at least in this locality. It has never been my fortune to meet with one in spring, though I have seen many in the fall; judging from analogy, it must pass through the Middle States along with the mourning warbler toward the latter part of May, or beginning of June. It returns late in September, and remains but a short time. Of its habits and notes I know nothing, except that in autumn it frequents low, bushy swamps, such as the Maryland yellow-throat chooses for his home, and utters, at times, a feeble chirp. Why it should be so exceedingly rare in spring, while in the fall it is comparatively common, I can scarcely even conjecture: perhaps it may choose a different route for its northern migration from what it pursues on its southern. The same circumstance may be noticed in the migrations of many other species, though in a much less marked degree.

The Blue-winged Yellow Warbler (*Helminthophaga pinus*) is one of that subdivision of the warbler family called the "Worm-eaters," or, in scientific language, *Vermivoræ*. The members of this division are distinguished from the typical warblers by sharper and more pointed bills, by plainer colors, and, as a rule, by comparatively harsh and unmusical voices. Their habits partake more of the vireo character than the others; in fact, they bear nearly the same

relation to the *Vireonidæ*, that the *Myiodioctæ*, of which the green black-capped warbler is a member, do to the *Muscicapidæ*, or Flycatchers. The blue-winged yellow warbler is one of those that spend the summer with us; but though it is quite abundant during that season, I have never been fortunate enough to discover its nest, although I have repeatedly seen the young just fledged. It arrives about the tenth of May, and takes up its abode in the closest thickets and underbrush. Its note is very forcible and characteristic; once heard, it will always be remembered. It is a rapid chirrup, nearly undescribable in words, though the following syllables bear some resemblance to it, *chāāchich-k'-a-re-r'r'r'r'r'*, uttered very quickly. It leaves in August.

The Mourning Warbler (*Geothlypis Philadelphia*) is a very rare species, scarcely less so than the Connecticut warbler. It arrives late in spring, about the twenty-fifth of May, or first of June; of its notes and habits I know nothing, having only seen one or two individuals. This and the Connecticut warbler have been considered by some ornithologists to be identical, but they are undoubtedly perfectly distinct.

One of the rarest of all is the Cape May Warbler (*D. tigrina*). Like the preceding, it is a late comer, arriving generally toward the end of May, and staying a very brief period. In the autumn it passes here, on its southward course, about the twentieth of September. Of its notes I know nothing, except that it has a faint chirp like all the other warblers; and of its habits, nothing worthy of particular notice, except that it shows a preference to cedar, and other evergreen trees.

The Green Black-capped Warbler (*Myiodioctes pusillus*) is one of those belonging to the section or genus intermediate between the warblers and flycatchers. It is very much nearer the former, however, than the latter; and it is a matter of some little surprise, how it could have been ranked as a flycatcher. Audubon says that it passes through the Middle

States very quickly on its way northward; but I have seen it from the nineteenth to the thirtieth of May, though never in abundance. It keeps low down in the trees, and is fond of haunting thickets and open brush-fields. Its ordinary note is a sharp chirp, but occasionally it may be heard to utter a loud, rapid, chattering song, which it repeats at short intervals. It is distinguished by its activity, even among a class of birds preëminent for that quality.

The Canada Warbler (*Myiodioctes Canadensis*) belongs to the same genus as the preceding, and like it was once classed as a flycatcher. It arrives about the middle of May along with the greater mass of warblers, and remains till the first of June. It is very unsuspicious, and more familiar in its habits than most of the warblers. With me, during some seasons, it is exceedingly abundant; at others it is scarcer, though never rare. It affects the lower branches principally, and is always very active. Its song is one of the most agreeable which we hear, though unfortunately it is seldom heard in this part of the country.

The Blue Warbler (*D. cærulea*), is a very rare species: that is to say, in the New England and Northern-middle States, its natural home being the south and the south-west, where it is extremely abundant. It very rarely reaches the New England States, though in the southern parts of Pennsylvania and New Jersey it sometimes occurs in considerable numbers. In a "Catalogue of birds observed in New York, Long and Staten Islands, and the adjacent parts of New Jersey," by Geo. N. Lawrence, no mention of it is made, although the list is very full and complete, embracing many species not before known to occur in those localities. I have only once seen it, and that was on the ninth of May, when I saw a single individual. In general appearance it resembled the female black-throated blue warbler, for which, indeed, I at first mistook it. It had no note of any kind.

The Maryland Yellow-throat (*Geothlypis trichas*) belongs to the *Geothlypeæ*, or Ground Warblers, so named because

they show a marked preference for the ground, seldom ascending to the tops of the trees as the others do, but being always found in the low thickets and bushes, or even on the ground. The present species is, perhaps, the best known, and most familiar of all its tribe; indeed it could not have otherwise obtained its familiar name of "Yellow-throat." It is scarcely necessary to add anything concerning it; suffice it to say, that it holds a most important position in the woodland choir; there is scarcely another bird that we should miss more. Without it, the thickets and coppices would seem almost uninhabited; and its song, simple though it is, would be sadly missed in August, when the hot summer sun has silenced the wood-thrush and the veery.

The Nashville Warbler (*Helminthophaga ruficapilla*) is, in this vicinity, quite an abundant species. It arrives about the twentieth of May, and, after staying a very short period, proceeds northward. During its stay it is shy and retiring, frequenting the tops of forest trees; occasionally it may be seen in orchards, and in the trees lining the brooks and swamps. It returns about the last week in September, remains a few days, and then moves off to the south. It has quite a fine song, which resembles that of the yellow warbler more nearly than any other. Many of the warblers have songs, so closely resembling each other, that it is impossible to describe them accurately in words, though they can at once be distinguished in the woods by the practised ornithologist.

The Blue Yellow-backed Warbler (*Parula Americana*) is one of the smallest, as well as one of the most beautiful of all. Usually very abundant, it is sometimes rather scarce, and its migrations seem to be somewhat irregular. It arrives in the second week in May, and remains a considerable time with us. About the time the apple and pear trees are in bloom, it is most abundant; and any one visiting orchards then, is sure to see it flitting among the blossoms like a winged gem, the dark blue and gold of the bird contrasting

beautifully with the pure white, or delicate pink, of the flowers. In autumn, it is one of the first, if not *the* first, to leave its northern abode and pass through the Middle States, appearing in my locality about the second or third week of September. After haunting, for a few weeks, the white-birch swamps, it moves southward, just as the black-throated blue warbler is arriving. The song of the blue yellow-back is a little sharp and lisping, yet quite varied, and very pleasant to be heard.

The Worm-eating Warbler (*Helmitherus vermivorus*) is one of the very few warblers that are plainly attired, yet even it can make some pretensions to personal beauty; for it has four bands of jet-black on its head, and a dainty suit of light buff on its back. It is not at all common, arrives in the middle of May, and has at that time a rapid, chattering note. It always keeps near the ground, is fond of rustling among the dead leaves of a broken bough, and, besides its chattering song, has, in June, a series of odd notes much like those of the white-breasted nuthatch, but more varied and musical, though hardly entitled to be called a song. It remains with us during the summer, and although I have seen it during the breeding season evidently collecting food for its young, I have never been able to find its nest.

The Hooded Warbler (*Myiodioctes mitratus*), is seldom seen as far north as the neighborhood of New York; in New England it is very rare. I have only observed two or three individuals; these were in low bushes, and seemed particularly active and restless. They are said to have a lively sort of warble, though I have never heard their notes.

Of the Prairie Warbler (*D. discolor*) I know but little. It is said to be abundant in many parts of New Jersey and Long Island, and to breed in those sections. It arrives in the neighborhood of New York in the first week in May, and remains till the autumn, frequenting, in spring, the orchards and gardens, and, in summer, the open, deserted fields and pastures. It has quite a variety of notes, some of which are very pleasing.

The Black-polled Warbler (*D. striata*), is the last of the tribe to arrive in spring, seldom appearing before the twentieth of May. It is a familiar species, being found, while with us, in gardens, orchards, and in the vicinity of houses, as well as in the woods. It is extremely active, and, when seen, is always darting in and out among the branches, so rapidly as almost to pain the eye in endeavoring to follow it. In the fall it returns very early, along with the blue yellow-backed warbler, in the middle of September, from which time until the end of the first week in October, it is very abundant. The young are then so much more numerous than the adults, that one sees twenty in the immature plumage, to one in the mature. As before stated, the young of this bird very closely resemble those of the bay-breasted warbler; so closely, in fact, that naturalists are puzzled to decide which of the two is the autumnal warbler of Wilson and Nuttall, the descriptions applying nearly as well to the one as to the other. It is probable, however, that Wilson did not distinguish between them, or else considered them merely as varieties of the same species. His detailed description of *Sylvia autumnalis* will certainly apply more nearly to the bay-breast; but when he comes to speak of its habits, his remarks apply to the *D. striata*, rather than to the *D. castanea*. All the ornithologists who wrote of the autumnal warbler, mention it as exceedingly abundant in the fall. The black-poll is then very common, as well as in the spring, while the bay-breast is never so. Audubon, and some other authors, find the *S. autumnalis* in the young of the Hemlock Warbler (*Sylvicola parus*); but their view must be incorrect, if the *S. parus* is, as Professor Baird asserts, merely the young of the Blackburnian warbler. During spring, the black-poll has a faint lisping song, of four or five syllables; in the fall, only a faint chirp.

The Blackburnian Warbler (*D. Blackburniæ*) is one of the most beautiful of all the warblers, for none can show more pleasing colors than the orange of its throat and breast.

It is a scarce species, arriving in the second or third week in May, and remaining till the first of June. In its habits it is shy and retiring, hiding itself in the thickest foliage. It sometimes utters an agreeable song. According to Giraud, it has been found breeding near Williamstown, Mass.

Another warbler, vying in beauty with the last, is the Black and Yellow Warbler (*D. maculosa*); and, to add to its attractiveness, its song is no less pleasing to the ear than its colors to the eye. About the middle of May it arrives, sometimes in great abundance, and again in very small numbers, in some seasons being scarcely seen at all; in fall, it is not as common as in spring. Its notes are very soft and musical; like the vireos, it sings while engaged in actively searching for food. It often darts after its prey, in the manner of the redstart, spreading its tail at the same time, as if to exhibit its beauty. In its motions, it is very quick, scarcely less so than the black-poll; in its choice of abode, it seems to have no particular preference, haunting alike the woods, orchards, roadsides, and gardens.

The Redstart (*Setophaga ruticilla*) is the only representative we have of the *Setophageæ*, a subdivision of the warbler family, noted for the extreme brilliancy of their plumage. There are several species in Mexico and the adjacent portions of the United States, but only one ever enters the Northern or Middle States. The redstart is so named, it is supposed, from the color of its tail (German *roth*, red; and *stert*, tail), and no more appropriate name could have been found to distinguish it, at least in the case of our bird; for of all its characteristics, that which at once strikes the beholder, on first seeing it, is its broad red tail. In the woods, it can easily be recognized, however far off, or however momentary the glimpse one catches of it, by the peculiar motion of the tail, which it flirts about from side to side, opening and shutting it occasionally like a fan. Although Wilson states that the redstart remains all the summer in Pennsylvania, and

that it breeds there in abundance, it is seldom seen in this locality after the end of June, although from the beginning of May until that time it is exceedingly common. About the first of September it reappears, and in a short time becomes abundant, remaining so for a few weeks, when it disappears again. It has a number of notes, some of which are very agreeable, especially its spring warble, which has been well described by Nuttall. Its peculiar habits are too well known to require any farther comment.

These species are about all that are to be found in the New England States. There are a few, however, not enumerated above, that occasionally visit them, stragglers from their more proper places of abode. Of these, those that are most likely to occur are the Kentucky Warbler (*Oporornis formosus*), which has been discovered on Long Island several times; the Golden-winged Warbler (*Helminthophaga chrysoptera*), which undoubtedly migrates as far north as Massachusetts; and the Tennessee Warbler (*Helminthophaga peregrina*), which has been shot in the neighborhood of New York City. The Orange-crowned Warbler (*Helminthophaga celata*), is also said to have been found in New York State; and, of course, may occur in the adjacent parts of New England. Its occurrence is very doubtful, however, and is still a subject of dispute.

It would scarcely be proper, in an account of the warbler family, to overlook the Water-thrushes (*Seiurus*), which are now generally classed among the *Sylvicoleæ*, or typical warblers, although their proper place in our systems has long been a matter of discussion. Audubon placed them among his *Motacillinæ*, or wagtails; while Wilson regarded them as true thrushes. Wilson, however, is not to be relied upon in matters relating to classification; he excelled as a descriptive naturalist, but not as a systematist. The specific rank of the water-thrushes, or wagtails, now seems to be universally acknowledged; and there can be little doubt, but that the position assigned to them by Professor Baird, is the correct

one. The reason why they were misunderstood so long, seems to have been their large size and plain colors, combined with a certain thrush-like appearance; they are, however, in their habits and notes, true warblers; more truly so, in fact, than the *Vermivoreæ*, or the *Geothlypeæ*.

Our commonest species is the Golden-crowned Thrush (*Seiurus aurocapillus*). It appears in the New England States in the first week of May, and, taking up its abode in the thickest woods, soon becomes abundant there. It runs along the ground with a graceful, wavering gait, wagging its tail all the while as if to preserve its balance, which seems every moment about to be overthrown. It often mounts to the boughs, from which it sends forth a loud, rattling chant, which can be heard at a considerable distance. At times, in the dusk of the evening or the early morning, it utters a finer song, clear and rapid as the canary's, ending almost always, however, in the usual chatter. While singing, it keeps high up among the trees, usually balancing itself on its wings like a skylark, descending just as it finishes its song. The only author in whom I find mention of this song is Nuttall, who has the credit of being one of our most observing naturalists. Late in summer, it has a sharp, clucking note, something like that of the water-thrush. Its curious nest has long been known; from it, it derives its name of "Oven-bird."

The Water-thrush (*Seiurus Noveboracensis*) arrives two or three weeks after the golden-crown; and, like most of the warblers, remains but a short time with us in the spring, passing on to the north to breed after a brief stay of eight or ten days. A singular circumstance in this bird's history is the fact of its never singing while here in spring; but during its visit on its return, it may often be heard. With all other birds, it is exactly the reverse. It haunts the same localities as the golden-crown, but shows more preference to the margins of small streams and ponds, along which it is seen running with the peculiar motion of

a sand-piper, for which, at a distance, it may easily be mistaken. Its ordinary note is a loud, sharp "cluck;" but in August, when it returns, it has a beautiful song, loud, clear, and sweet, rivalling that of the wood-thrush for beauty. It is quite abundant.

There is a closely allied form of the water-thrush, which is probably entitled to specific rank; the Large-billed Water-thrush (*Seiurus Ludovicianus*). Audubon first discovered it, and at the time considered it as distinct from the ordinary bird, but afterwards held it merely as a variety. The two birds certainly present greater difference than other nearly allied species of warblers that are acknowledged to be distinct, as the Connecticut and mourning warblers; and there is little doubt but that they are really different species. I have seldom seen the large-billed water-thrush, and am inclined to think that it is much rarer than the common wagtail, in this part of the country at least. In its habits and general appearance it seems to be the same as the *aurocapillus*, which may partly account for the fact that it is rarely noticed. I have never heard its notes; they are said to be eminently beautiful, almost equalling those of the nightingale.

NOTES ON TROPICAL FRUITS.

BY WILLIAM T. BRIGHAM.

It may be that one day we shall know the different varieties of oranges, of coffee, of sugar-cane, as we know the pears and apples of our own orchards; but at present we know only that some kinds are better than others. Travellers often describe in glowing terms the tropical fruits, but most of us know the banana (the apple of the tropics) by one typical form. The pleasant season for travelling in the tropics is not the season of fruits, so that many are not noticed by the

tourist; and again, most tropical fruits do not commend themselves to the taste on first acquaintance. If by offering a few random notes of a traveller who considers fruit and vegetables the staple of life, especially in the tropics, contributions from other sources may be provoked, some pleasing sketches of the many delicious products of the warmer regions of the globe may result.

Colocasia antiquorum, var. *esculenta*,—Kalo or Taro. The kalo of the Pacific Islanders is one of the few tropical productions that require great labor and constant care to bring it to perfection. In its wild state, like most of the Araceæ, the kalo has a small corm, or bulb, surmounted by a few arrow-shaped leaves with fleshy stems. It looks much like the Calla of our conservatories. The corm is acrid, and blisters incautious lips. What can have first suggested its use as food? To cultivate it, ponds are prepared by carefully digging the soil and working it with the feet to the depth of some eighteen inches. The ponds are surrounded by a low wall or dyke, and usually cover from a few square yards to half an acre. Water is supplied by an aqueduct.

The upper part of the corm, with the half-developed leaves, is cut off and planted in the mud, usually in rows about a foot apart, and water turned on enough to cover the soil about an inch. Weeds and kalo then commence a race, and it requires the constant care of the owner to keep the former down until the kalo leaves cover the ground. As the kalo leaves unfold, and the bulb grows, more water is let into the pond, and it is sometimes a foot deep. At the end of thirteen months the bulb has attained full size, and the yellow fragrant blossom appears. It is not necessary to gather it at once, and the usual way is to pull it as needed, replanting the stems, so that a constant succession is kept up. One acre will furnish food for six men.

When fully grown, the bulb is six inches or even a foot in diameter, and the bright leaves have closely covered the surface of the pond. The bulb is still as acrid as when it

the wild state, except a rare variety which may be eaten raw, and must be baked to render it eatable. This process is usually performed in earth-ovens, and the roasted vegetable is pounded with great labor into a paste with water. It is at first tough and elastic, but at last the persistent attacks of the stone-pounder reduce it to a paste not unlike mashed potato. This constitutes the pae-ai of the Hawaiians, and may be kept for a long time packed in leaves of the cordyline. When mixed with water in different proportions, it forms "one-fingered poi," or "two-fingered poi," or even "three-fingered poi," accordingly as a mouthful may be taken up on one, two, or three fingers. It is preferred slightly sour, and to a stranger much resembles in smell and appearance sour bookbinder's paste. A fastidious man objects to the way in which a group of natives, seated around a calabash of poi, which an old woman has just stirred up with her hand, dip their fingers in the paste and empty them in their mouths; but if he wishes a good meal he had better get over such prejudices. Babies a few weeks old are passionately fond of poi, and foreigners, who have long lived in poi countries, often send for it half round the world.

The bulb may also be cooked and eaten as a potato, when it is very palatable, or as a farther process the boiled kalo may be cut in slices and fried, or mashed into paste like poi and made into cakes while yet fresh, a food as dear to those used to it as johnny-cake to a Scotchman. Even the stems are boiled as greens, and the tender leaves form a fine dish called luau.

Although kalo is usually grown in ponds or brooks, a very good variety grows well on upland rich soil, and many prefer it to the more common kind. The Hawaiians distinguish more than fifty varieties of this plant, and the paste made from them varies in color, from a bluish-gray to a rich pink-color. Poi requires a little salt-fish as a relish. Kalo grows in New Zealand, Australia, China, where it is carefully cultivated, India, and elsewhere; but the Polynesians, especially

the Hawaiians, alone make poi, other people using the bulb like yams or potatoes. It is said that the corm of the common Jack-in-the-pulpit of New England woods may be treated as kalo, even to the eating.

Pandanus verus, Vaquois, Screw-pine, Lauhala. The pandanus, with its aerial roots and terminal tufts of long graceful leaves, is known by many pictures, but few have eaten the fruit. This much resembles a pine in shape and size, and is hard and useless until fully ripe, when the pulp surrounding the nuts is mashed into a paste and eaten. Many of the atolls in the Pacific produce no other food except the omnipresent cocoa-nut. The taste is rather insipid, and the odor disagreeable. The flower is fleshy and fragrant, and the native doctors in India use it as a sort of love-potion. It is certainly an emetic to some constitutions. The aerial roots have their ends protected by a loose cap or thimble of cellular integument, which is at once absorbed where the root touches the ground. From the peculiar disposition of the leaves they shed water only from the tips and down the stem, forming a complete shelter from the rain, and supplying water where most needed.—*To be continued.*

THE GOLDSMITH BEETLE, AND ITS HABITS.

BY REV. SAMUEL LOCKWOOD.

Among the Beetles of North America, very few can bear away the palm for beauty from the *Cotalpa lanigera*, or, popularly known, the Goldsmith Beetle. This insect holds no ignoble place in the Coleoptera, being a member of the family Rutilidæ, or the golden-gleaming ones. Indeed Madam Cotalpa has long been an acknowledged belle among the Rutilians, themselves a distinguished family in Beetledom. No artist can vie with the gorgeous effect pr

duced by the metallic tints of the Cotalpa's dress. Who has not seen the maiden sporting in a silken attire of but one color, which with every motion in the light became suddenly lustrous with beautiful hues. Almost a monochrome, yet the garb of the Goldsmith beetle presents a rich diversity of tints, chiefly of the yellow sorts. The wing-cases are a gleaming lemon, thus making the whole back appear as if encased by two large plates of paly gold, while the thorax and head are each covered with brilliant red gold, which in the light gives off an almost flaming hue. "The legs are brownish yellow, or brassy, shaded with green." The under part of the insect is a sheet of highly polished copper, from which stands forth a thick coat of "whitish wool," justifying its specific name *lanigera*, wool-bearer. It is pleasant to see how from such a seeming paucity of color, Nature has begotten in this insect such a richness of results. Although with a softer toning down, we see a not dissimilar success in that fine large Bombyx, the pale-green, satin-robed Moon-moth (*Attacus luna*), "preëminent above all our moths in queenly beauty."

In the month of May for many years, in the ordinary culture of my garden at Keyport, N. J., the spade has turned up the *Cotalpa lanigera* (Fig. 1, larva; Fig. 2, imago),

Fig. 1.

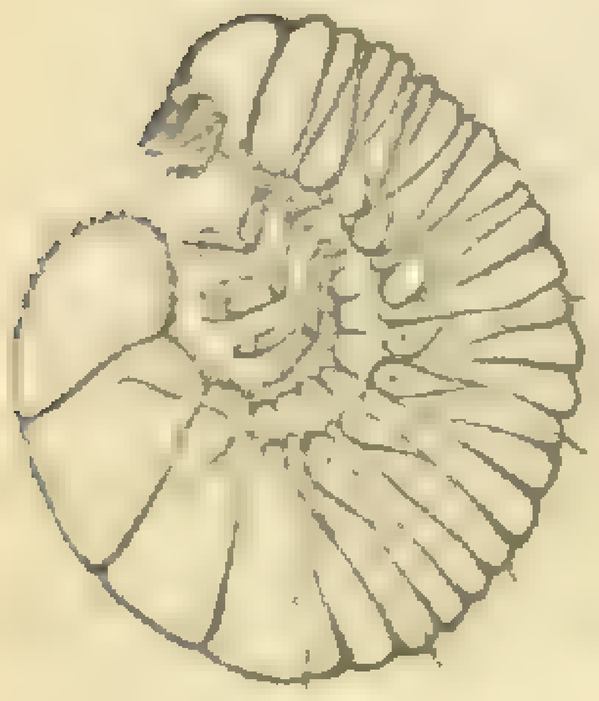

Fig. 2.

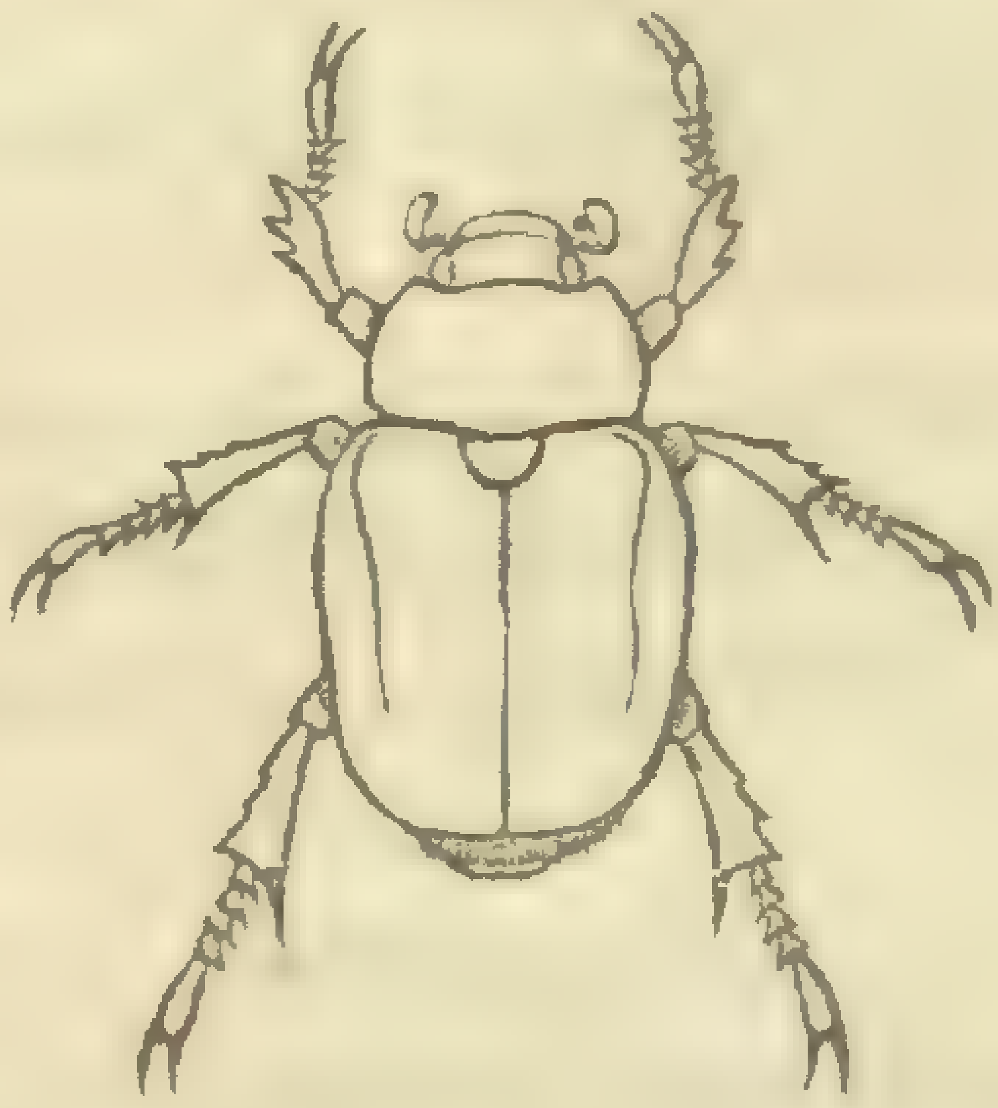

Fig. 3.

and generally in company with the May-beetle, or Dor-bug (*Lachnosterna fusca*, Fig. 3, pupa). The beetle is figured in the NATURALIST, Vol. I, p. 222. Each season has furnished me many more Dors than Goldsmiths. And so far

as my observations tend, the former are individually more mischievous.

To me the question of origin was interesting. Where did the Goldsmiths come from? It is a tree-beetle, and the spade turns them up in the ground. Do they originate in the trees or in the ground? Or is the latter the place for their winter sleep, and for the purpose of undergoing their transformations? On this point, I found the authorities all simply quoting Harris, who says, "the larvæ of this insect are not known; probably they live in the ground upon the roots of plants." My mind was made up to watch. If Newton could say in effect that to the astronomer patience is genius, the burden of the naturalist's "Life Psalm" is: "Learn to labor, and to wait."

For five years was kept up that vernal watching, every May yielding specimens, but no secrets. In the spring of 1865, to my surprise I turned up a fine, fresh, pale imago out of a small heap of dirt that I had put there the previous autumn. This gave a new impulse to investigation. For, that the imago was not there when I made the mound, I was positive; nor could it have entered there during the winter. Hence it was beyond doubt that I had unwittingly carried the larva there myself; or, as I think more probable, the advanced pupa. That month a very strict watch was kept for all specimens that might be turned up by spade or plough, with the hope that a pupa, or a newly, but not quite developed imago, would be obtained. All was in vain. The next step was to examine very thoroughly every larva of a coleopterous kind found in proximity with the imagos. This led to the discovery that certain large whitish grubs about one inch and three quarters long, and over half an inch thick, had a yellowish brown scale on the part corresponding to the thorax, and it was thought it might ripen into the red golden hue of the thorax of the perfected insect. This decided my course. Like Scholasticus, who, having heard that the crow lived a hundred years, at once went to

market, bought a young one, and resolved that he would see; I filled a deep glass jar with earth, and placed six large grubs on the top. It was interesting to observe how quickly these soft creatures burrowed out of sight. They seemed in distress and haste to get out of the light and heat.

Five months after,—it was late in October,—I removed a portion of the earth in the jar. Judge of my delight and astonishment to find a beautiful and perfect Goldsmith beetle in the earthen chamber, which had contained it in its pupa state. I now searched the jar carefully, and found two more seemingly perfect ones, and another ill-formed one. So my conjectures were right. Those white grubs were, indeed, the larvæ of the *Cotalpa lanigera*. Without farther disturbance, except to replace the earth, the jar was set away in the cellar for the winter.

Next May it was again examined. During the month two very pretty ones came to the surface of their own accord. I was delighted to find it was a pair, male and female. Farther examination showed that of the six larvæ, five became imagos, and one died in the pupa state. They were all Goldsmiths. Being particularly anxious about the pair, from which I had hoped to learn something respecting the time and mode of oviposition, extra attention was paid them, and young leaves of the different deciduous trees were supplied; but in vain. They lived but a few days, and died without furnishing one fact.

Now comes a curious question. These insects had lived in the perfect form from October until May, a little more than seven months, that is, the larger fraction of a year. Is this their habit? Do they thus spend, after the last metamorphosis, so much time in a subterranean life? Probably there are two reasons why I have never found the Goldsmith in the fall; the little need of working the ground then, and the probability that the spade or plough does not go deep enough; as in May, the insect is slowly travelling to the surface, and is met by the implement.

When collecting the larvæ in May, I often observed in the same places grubs of the Cotalpa of at least four distinct ages, each representing a year in the life of the insect, judging from Renny's figures of the larvæ of the English Cockchafer, or Dor-beetle (*Melolontha vulgaris*). But the English chafer becomes an imago in January or February, and comes forth into active life in May, just four years from the deposit of the egg. Supposing our Cotalpa to take on the imago form in autumn, and to spend its life from that time to the next May in the ground, it would be five years old when it makes its debut as an arboreal insect.

The books tell us that the larvæ of the Coleoptera always lie on their side. Why? Watching the movements of the Goldsmith in its chamber, I noticed that the cell, or cave, was made large enough to admit of considerable freedom of motion. Lying on its side, and in a curved posture, the larva secures for itself comfort, and the largest movement as respects allotted space; also by the curved motions the made, the enlarging and keeping up the walls of its earth-chamber. The dog, in setting itself for repose, shows the old instinct,—first the whole body is put in a curve, next a circular motion is made, then it sinks upon its bed. This is the wolf making its bed. And this posture of repose more effectually defends the abdominal, the weaker parts of the body. It is so with the grub. Resting on its side, it in fact rests upon the ends of the hard dorsal segments, by the extension and contraction of which the cycloidal motion is attained, without any friction to the tender abdomen, while the friction of the back keeps the walls of the earth-chamber compact and smooth.

I laid a large larva on my study-table. It instantly turned on its round, smooth back, nicely balanced itself, and with feet upward, moved quite rapidly. One might call the movement serpentine. In fact, the motion was acquired by the separating and bringing together again of the hard segments, very much as the ventral bands or scales of the

snake are moved by the ribs; the tenderness of the abdomen and feet accounting for this singular upside-down way of getting along. It certainly was an effectual getting over the difficulties of a new situation. But this experiment, tried with a younger larva, turned out otherwise. It travelled on its abdomen, and would not, even when so placed, go at all upon its back. It seemed to me that the dorsal segments were too soft to afford it the advantages thus had by the older individual.

I think the Goldsmith prefers land under present tillage, and that the dor-bug loves grassy land better than garden soils; hence the latter is to be regarded as the more injurious of the two. The Goldsmith beetle is very short-lived. It is likely that the female lays her eggs in the ground in June, which month usually sees her for the last time. Their life I hardly think is given to much mischief. Says Harris, "pear trees are particularly subject to their attacks." A more recent observer, Mr. Uhler, indicates that its injury is not serious to this tree, and that it is more frequently found on other trees. It appears to me to be far from particular in its taste; for besides the trees mentioned by Dr. Harris, "the pear, hickory, poplar, and oak," I have found it on the Abele, or white poplar of Europe, the Bilsted, or sweet gum, and seen it eating the Lawton blackberry. For the double purpose of concealment from enemies and comfort of shade, it will draw together a couple of leaves, holding them by the sharp tiny hooks or grapnels on its feet. Of sluggish habits and but low instincts, it quietly nestles in its improvised arbor all the long summer day. At morn and evening twilight it ventures abroad, seeking its food, flying and buzzing about, enjoying its arboreal life, short at best, and to many very short indeed, as they fall an easy prey to the ever-watchful birds. Sometimes their little round of existence is abruptly broken in a very unsentimental way. The little Cotalpa, brimful of life, unintentionally enters the open window, and, dashing bewilderingly in a sort

of involuntary blind-man's buff, strikes its tiny golden visor against the blinding lamp. Ah, thy doom is sealed! A feminine scream. Then the nervous mistress, napkin in hand, courageously attacks, and with the scissors triumphantly captures, and most satisfactorily destroys "the pesky thing!"

NOTE.—Fig. 3 represents the pupa of *Lachnosterna fusca*, the June bug, which was turned up by the spade in a garden in Maine, about the middle of May. The pupa of Cotalpa must closely resemble that of the June bug. It will be seen in our review of the Cosmos, that the cockchafer lives three years instead of five as stated by early authors.—(EDS.)

THE OSPREY, OR FISH-HAWK.

BY AUGUSTUS FOWLER.

THIS well-known migratory hawk (*Pandion Carolinensis*) arrives on our coast about the last of April, and departs for the south in the month of October. It subsists entirely upon fish, which it procures by its own industry, laboring from morning till evening twilight. Upon examining this bird it will be seen by its peculiar organization how well it is adapted for its vocation. The body is compact and strong; wings long, pointed, and extremely powerful; the femur and tibia muscular; the soles of the feet supplied with hard scaly protuberances, which, with its long, sharp, round claws, prevent its prey from slipping from its grasp when once fairly struck. In the Osprey the wings denote great power; they are acute and long, and, as the wing is the lever of the power, the more distant its extremity is from the centre of motion the more power it has in resisting the air. The stiff, elastic quill-feathers arising from the wing of the osprey, called the primaries, are sixteen inches in length including the quills; the quills are three and a half inches long, and seven-eighths

of an inch in circumference; the feathers, arising from the spurious wing that lie close on the quills of the primaries are also very stiff and give them great support, each primary feather measuring seven-eighths of an inch in width from the greater wing coverts to near its extremity, with the lamina strongly connected by the fibrils of each; those on the upper edge of the shaft are stiff and curve downward, a wise provision in its construction without which the resistance of the air against the wing would be lost by a counteracting resistance in its ascent. In its downward beat on the air the flat surface of the feather only presents itself, in its upward stroke its edges are presented, and the air passes through them. Thus the curvature, length, and power of the wings of the Fish-hawk are designed to be of great service under peculiar circumstances. Rising high in the air and wheeling in his flight, he discovers his finny prey far below him in the water. He poises himself for a moment, then swiftly descends upon his victim. The fish feeling the piercing claws of the hawk, leaps forward through the water, and, having his head lifted up by the power of the hawk, swims to the surface and is easily borne into the air; these are the more favorable circumstances for the hawk.

There are instances when in striking the fish the hawk fastens to him less favorably, and does not so easily succeed in procuring his prize. When the hawk has seized his prey so far behind as to give the fish an opportunity of descending deeper in the water, he is sometimes drawn under its surface, especially if the fish is large. When this occurs the struggle is desperate, for the contest is, which will now remain in his element. It is to the advantage of the hawk, being placed in such hazardous circumstances, that his wings are differently constructed from those of other hawks. Those long, stiff, elastic quill-feathers arising from the hands of the wings of the hawk which curve to such a degree as to be used over his body while partly submerged in the water, give him the victory. After the osprey has secured his prey he rises from

the water and shakes himself, then immediately starts for the woods or some stand to feed upon his spoils. Having reached the tree upon which he intends to light, he circles around two or three times before he rests upon it; so cautious is he lest the Bald-eagle (*Haliaetus leucocephalus*), which so often robs him of his food, may approach him unseen, he remains looking about him for some minutes before commencing to eat; no danger being apprehended, he then strips off a piece of the fish and swallows it. After every mouthful he takes a survey.

A number of years ago a pair of fish-hawks built their nest in Ipswich, Mass. They were so often shot at, and the nest robbed of their eggs, that they abandoned the spot. Their nest is composed chiefly of sticks and seaweed; it is large for the size of the bird, measuring three feet in diameter and two feet in height; the cavity for the reception of eggs is shallow, as is usually in nests of all birds of prey. The attachment between the male and female is strong; the former not only assists in incubation, but also supplies the female with food while performing the arduous task; after having brought her a fish he will rise above the nest in a spiral flight to a great height, then descending on half-closed wings with great force until near the nest, he sweeps around uttering a piercing scream. The female acknowledges the honor thus paid her by rising in the nest and partly extending her wings. The fish-hawk usually lays three eggs, sometimes four; their ground color is white tinged with red; the larger end is sometimes almost entirely covered with blotches of dark umber brown, and spots of the same color are thickly scattered on the smaller end; they vary in size, usually they are two and a half inches in length by one and seven-eighths inches in diameter. At the earliest dawn of day the labors of this fish-hunter commences. He seems to know no danger in the oftentimes perilous undertaking of fastening to a too powerful fish. He crosses our bays, enters the rivers and creeks, still pursuing the chase in wet or dry weather, appar-

ently for the pleasure and excitement it gives, rather than to procure for himself food. This insurmountable passion he gratifies without the least fear of plunging from the great height to which he soars, whizzing through the air swifter than the torrent into which he rushes, making the water foam around him. Night often overtakes him in the heat of the pursuit, and not until the last ray of light has disappeared in the west does he forsake the chase. His day's hunt over, he perches upon some tree bordering upon the shore of the river or coast of the sea, and remains through the night. He is awakened by the freshness of the morning air and the roar of the long rolling waves when their irresistible columns meet the shore and are broken. He rises and shakes the dews of night from his feathers, gives them a few touches with his bill, and again goes forth, rejoicing in his strength, over waters filled with a superabundance of food.

THE PARASITES OF THE HONEY-BEE.

BY A. S. PACKARD, JR.

VERY few bee-keepers are probably aware how many insect parasites infest the Honey-bee. In our own literature we hear almost nothing of this subject, but in Europe much has been written on bee parasites. From Dr. Edward Assmuss' little work on "the Parasites of the Honey-bee," we glean many of the facts now presented, and which cannot fail to interest the general reader as well as the owner of bees.

The study of the habits of animal parasites has of late gained much attention among naturalists, and both the honey and wild bees afford good examples of the singular relation between the host and the parasites which live upon it. Among insects generally, there are certain species which

devour the contents of the egg of the victim. Others, and this is the most common mode of parasitism, attack the insect in its larva state; others in the pupa state, and still others in the perfect, or imago state. Dr. Leidy has shown that of the wood-devouring species, a beetle, *Passalus cornutus*, and some *Myriapods*, or "thousand legs," are, in some cases, tenanted by myriads of microscopic plants and worms which luxuriate in the alimentary canal, while the "caterpillar-fungus" attacks sickly caterpillars, filling out their bodies, and sending out shoots into the air, so that the insect looks as if transformed into a vegetable.

The Ichneumon flies, of which there are undoubtedly several thousand species in this country, are the most common insect parasites. Their habits are noticed in the NATURALIST, Vol. I. p. 81. Next to these are the different species of *Tachina* and its allied genera. These, like Ichneumons, live in the bodies of their hosts, consuming the fatty parts, and finishing their transformations just as the exhausted host is ready to die, issue from their bodies as flies, closely resembling the common house-fly.

An insect, allied to the Tachina, has been found in Europe to be the most formidable foe of the hive-bee, sometimes producing the well-known disease called "foul-brood," which is analogous to the typhus fever of man.

This fly, belonging to the genus *Phora* (Plate 4, fig. 1, *Phora incrassata*; Fig. 2, larva; Fig. 3, *puparium*), is a small insect about one line and a half long, and found in Europe during the summer and autumn flying slowly about flowers and windows, and in the vicinity of bee-hives. Its white, transparent larva is cylindrical, a little pointed before, but broader behind. The head is small and rounded, with short three-jointed antennæ, and at the posterior end of the body are several slender spines. The *puparium*, or pupa-case, inclosing the delicate chrysalis, is oval, consisting of eight segments, flattened above and with two large spines near the head, and four on the extremity of the body.

When impelled by instinct to provide for the continuance of its species, the Phora enters the bee-hive and gains admission to a cell, when it bores with its ovipositor through the skin of the bee-larva, laying its long oval egg in a horizontal position just under the skin. The embryo of the Phora is already well developed, so that in three hours after the egg is inserted in the body of its unsuspecting and helpless host, the embryo is nearly ready to hatch. In about two hours more it actually breaks off the larger end of the egg-shell and at once begins to eat the fatty tissues of its victim, its posterior half still remaining in the shell. In an hour more, it leaves the egg entirely and buries itself completely in the fatty portion of the young bee.

The maggot moults three times. In twelve hours after the last moult it turns around with its head towards the posterior end of the body of its host, and in another twelve hours, having become full-fed, it bores through the skin of the young, eats its way through the brood-covering of the cell and falls to the bottom of the hive, when it changes to a pupa in the dust and dirt, or else it creeps out of the door and transforms in the earth. Twelve days after, the fly appears.

The young bee, emaciated and enfeebled by the attacks of its ravenous parasite, dies, and its decaying body fills the bottom of the cell with a slimy foul-smelling mass, called "foul-brood." This gives rise to a miasma which poisons the neighboring brood, until the contagion (for the disease is analogous to typhus, jail, or ship-fever) spreads through the whole hive, unless promptly checked by removing the cause and thoroughly cleansing the hive.

Foul-brood sometimes attacks our American hives, and, though the cause may not be known, yet from the hints given above we hope to have the history of our species of Phora cleared up, should our disease be found to be sometimes due to the attacks of such a parasite fly.

We figure the Bee-louse of Europe (Plate 4, fig. 4, *Braula*

cæca Nitsch), which is a singular wingless spider-like f allied to the wingless Sheep-tick (*Melophagus*), the wingl Bat-tick (*Nycteribia*), and the winged Horse-fly (*Hippobos* The body is divided into two regions, like the spider. Th head is very large, without eyes or ocelli (simple eyes), a the ovate hind-body consists of five segments, and is cover with stiff hairs. It is one-half to two-thirds of a line long. This spider-fly is "pupiparous," that is, the young, of whi only a very few are produced, is not born until it has, or i just about to, assume the pupa state. The larva (Plate 4, Fig. 5) is oval, eleven-jointed, and white in color. The ver day it is hatched it sheds its skin and changes to an ova puparium of a dark-brown color.

Its habits resemble that of the flea. Indeed, should w compress its body strongly, it would bear a striking resem- blance to that insect. It is evidently a connecting lin between the flea, and the two-winged flies. Like the forme it lives and brings forth its young on the body of its host and draws its food from its host by plunging its stout bea into the skin of the bee.

It has not been noticed in this country, but is liable t be imported on the bodies of Italian bees. Generally, o or two of the Braulas may, on close examination, be detect on the body of the bee; sometimes the poor bees are load down by as many as a hundred of these hungry bloodsucker Assmuss recommends rubbing them off with a feather, a the bee goes in and out of the door of its hive.

Among the beetles are a few forms occasionally found i bees' nests and also parasitic on the body of the bee. *Tr- chodes apiarius* Linn. (Plate 4, fig. 6, fig. 6 *a*, larva: fig. 6 pupa, front view) has long been known in Europe to att the young bees. In its perfect, or beetle, state it is fou on flowers, like our *Trichodes Nuttallii*, which is comm found on the Spiræa in August, and which may yet prove t enter our bee-hives. The larva devours the brood, but wi the modern hive its ravages may be readily detected.

The Oil-beetle, *Meloë angusticollis* Say (Plate 4, fig. 7, male, differing from the female by having the antennæ as if twisted into a knot; Fig. 8, the active larva found on the body of the bee), is a large dark-blue insect found crawling in the grass in the vicinity of the nests of Andrena and Halictus and other wild bees in May, and again in August and September. The eggs are laid in a mass covered with earth at the root of some plant. During April and early in May, when the willows are in blossom, we have found the young recently hatched larvæ in considerable abundance creeping briskly over the bees, or with their heads plunged between the segments of the body, greedily sucking in the juices of their host. Those that we saw occurred on the humble-bee, Halictus and Andrena, and various flies (Syrphus and Muscidæ), and there is no reason why they should not infest the honey-bee which frequent similar flowers, as they actually are known to do in Europe. These larvæ are probably hatched out near where the bees hybernate so as to creep into their bodies before they fly in the spring, as it would be impossible for them to crawl up a willow tree ten feet high or more, their feet being solely adapted for climbing over the hairy body of the bee, which they do not leave until about to undergo their strange and unusual transformations.

In Europe, Assmuss states that on being brought into the nest by the bee, they leave the bee and devour the eggs in the bee-cells, and then attack the bee-bread. When full-fed and ready to pass through their transformations to attain the bee state, instead of at once assuming the pupa and imago state, as in the Trichodes represented above, they pass through a *hyper-metamorphosis*, as Fabre, a French naturalist, calls it. In other words, the changes in form which are preparatory to assuming the pupa and imago states are here more marked and almost coequal with the larva and pupa states, so that the Meloë, instead of passing through three states (the egg, larva, and pupa), in reality passes through

these and two others in addition, which are intermediate. The whole subject of the metamorphosis of this beetle needs revision, but Fabre states that the larva, soon after entering the nest of its host, changes its skin and assumes a second larva form (Plate 4, fig. 9), which somewhat resembles the larva of the Goldsmith beetle (P. 187, fig. 2). Newport, who with Siebold has carefully described the metamorphoses of Meloë, does not mention this stage in its development, which he calls "pseudo-chrysalis." It is motionless, the head is mask-like, without movable appendages, and the feet are represented by six tubercles. This is more properly speaking the semi-pupa, and the mature pupa grows beneath its mask-like form, which is finally moulted. This form, however, according to Fabre, changes its skin and turns into a third larva-form (Plate 4, fig. 10, from Newport). After some time it assumes its true pupa form (Plate 4, fig. 11, from Newport), and finally moults this skin to appear as a beetle (Plate 4, fig. 7).

Fabre has also, in a lively and well-written account, given a history of *Sitaris*, an European beetle, somewhat resembling Meloë. He states that Sitaris lays its eggs near the entrance of bees' nests, and at the very moment that the bee lays her egg in the honey-cell the flattened ovate Sitaris larva drops from the body of the bee upon which it has been living, and feasts upon the contents of the freshly laid egg. After eating this delicate morsel it devours the honey in the cell of the bee and changes into a white cylindrical, nearly footless grub, and after it is full-fed, and has assumed a supposed "pupa" state, the skin, without bursting, incloses a kind of hard "pupa" skin, which is very similar in outline to the former larva, within whose skin is found a whitish larva which directly changes into the true pupa. In a succeeding state this pupa in the ordinary way changes to a beetle which belongs to the same group of Coleoptera as Meloë. We cannot but think, from observations made on the humble-bee, the wasp, two species of moths, and several other insects

that this "hyper-metamorphosis" is the normal mode of insect metamorphosis, and that the changes of these insects, made beneath the skin of the mature larva before assuming the pupa state, are almost as remarkable, though less easily observed, as those of Meloë and Sitaris. Several other beetles allied to Meloë are known to be parasitic on wild bees, though the accounts of them are fragmentary.

The history of *Stylops*, a beetle allied to Meloë, is no less strange than that of Meloë, and is in some respects still more interesting. On June 18th I captured an *Andrena vicina* (figured on p. 397 of the first volume of the NATURALIST) which had been "stylopized". On looking at my capture I saw a pale reddish-brown triangular mark on the bee's abdomen; this was the flattened head and thorax of a female Stylops (Plate 4, fig. 12, position of the female of Stylops, seen in profile in the abdomen of the bee; Fig. 13, the female seen from above. The head and thorax is soldered into a single flattened mass, the baggy hind-body being greatly enlarged like that of the gravid female of the white ant, *Termes*, and consisting of nine segments).

On carefully drawing out the whole body which is very extensible, soft, and baggy, and examining it under a high power of the microscope, we saw multitudes, at least several hundred, of very minute larvæ (Plate 5, fig. 6, as seen from above, and showing the alimentary canal ending in a blind sac; Fig. 6 *a*, side view), like particles of dust to the naked eye, issuing in every direction from the body of the parent now torn open in places, though most of them made their exit through an opening on the under side of the head-thorax. The Stylops, being hatched out while still in the body of the parent, is therefore viviparous. She probably never lays eggs.

On the last of April, when the Mezereon was in blossom, I caught the singular-looking male, *Stylops Childreni* Gray (Plate 4, fig. 14; *a*, side view; it is about one-fourth of an inch long), which was as unlike its partner as possible. I

laid it under a tumbler, when the delicate insect flew and tumbled about till it died of exhaustion in a few hours.

It appears, then, that the larvæ are hatched during the middle or last of June from eggs fertilized in April. The larvæ then crawl out on to the body of the bee, on which they are transported to the nest, when they enter, according to Peck's observations, the body of the larva, on whose fatty parts they feed. Previous to changing to a pupa, the larva lives with its head turned towards that of its host, but before assuming the perfect state (which they do in the late summer or autumn) they must reverse their position. The female protrudes the front part of its body between the segments of the abdomen of her host, as represented in our figure. This change, Newport thinks, takes place after the bee-host has undergone its metamorphoses, though the bee does not leave her earthen cells until the following spring. While the male Stylops deserts its host, his wingless partner is imprisoned during her whole life within her host, and dies immediately after giving birth to her myriad (for Newport thinks she produces over 2000 young) offspring.

Xenos Peckii, an allied insect, was discovered by Dr. Peck to be parasitic in the body of wasps, and there are now known to be several species of this small but curious family, *Stylopidæ*, which are known to live parasitically on the bodies of our wild bees and wasps. The presence of these parasites which live on the fatty parts finally exhausts the host, so that the sterile female bee dies prematurely.

As in the higher animals bees are afflicted with parasitic worms which induce disease and sometimes death. The well-known hair-worm, Gordius, is an insect-parasite. The adult form is about the size of a thick horse-hair, and is seen in moist soil and in pools. It lays, according to Dr. Leidy, "millions of eggs connected together in long cords." The microscopic tadpole-shaped young penetrate into the bodies of insects frequenting damp localities. Fairly esconced within the body of their unsuspecting host, they luxuriate on its fatty tis-

sues, and pass through their metamorphoses into the adult form, when they desert their living house and take to the water to lay their eggs. In Europe, Siebold has described *Gordius subbifurcus* which infests the drones of the honey-bee, and also other insects. Professor Siebold has also described *Mermis albicans*, which is a similar kind of hair-worm, from two to five inches long, and whitish in color. This worm is also found, strangely enough, only in the drones, though it is the workers which frequent watery places to appease their thirst.

Thousands of insects are carried off yearly by parasitic fungi. The ravages of the Muscardine, caused by a minute fungus (*Botrytris Bassiana* Balsamo), has threatened the extinction of silk culture in Europe. Dr. Leidy mentions a fungus which must annually carry off myriads of the Seventeen Year Locust. A somewhat similar fungus, *Mucor mellitophorus* (Plate 4, fig, 15), infests bees, filling the stomach with microscopic colorless spores, so as to greatly weaken the insect.

As there is a probability that many insects, parasitic on the wild bees, may sooner or later afflict the honey-bee, and also to farther illustrate the complex nature of insect parasitism, we will for a moment look at some other bee-parasites.

Among the numerous insects preying in some way upon the Humble-bee are to be found other species of bees and moths, flies and beetles. Insect parasites often imitate their host: *Apathus* (Plate 5, fig. 1, *A. Ashtoni*) can scarcely be distinguished from its host, and yet it lives cuckoo-like in the cells of the humble-bee, though we know not yet how injurious it really is. Then there is the *Conops* and *Volucella*, the former of which lives like Tachina and Phora within the bee's body, while the latter devours the brood. The young (Plate 5, figs. 5, 5*a*) of another fly allied to Anthomyia, of which the Onion-fly is an example, is also not infrequently met with. A small beetle (Plate 5, fig. 4, *Antherophagus*

ochraceus) is a common inmate of humble-bees' nests, and probably feeds upon the wax and pollen. We have also found several larvæ (Plate 4, fig. 16) of a beetle of which we do not know the adult form. Of similar habits is probably a small moth (*Nephopteryx Edmandsii*, Plate 5, figs. 2, 2*a*, larva; fig. 2*b*, chrysalis, or pupa) which undoubtedly feeds upon the waxen walls of the bee-cells, and thus, like the attacks of the common bee-moth (*Galleria cereana*), whose habits are so well known as not to detain us, must prove very prejudicial to the well-being of the colony. This moth is in turn infested by an Ichneumon-fly (*Microgaster nephoptericis*, Plate 5, figs. 3, 3*a*) which must destroy many of them.

The figures of the early stages of a minute ichneumon represented on the same plate (Fig. 7, larva, and 7*a*, pupa, of *Anthophorabia megachilis*) which is parasitic on Megachile, the Leaf-cutter bee, illustrates the transformations of the Ichneumon-flies, the smallest species of which yet known (and we believe the smallest insect known at all) is the *Pteratomus Putnami*, or "winged-atom," which is only one-ninetieth of an inch in length, and is parasitic on Anthophorabia, itself a parasite. A species of mite (Plate 5, figs. 9, 9*a*, the same seen from beneath) is always to be found in humble-bees' nests, but it is not thought to be specially obnoxious to the bees themselves, though several species of mites (*Gamasus*, etc.) are known to be parasitic on insects.

For a proper study of our bees and wasps, we should collect their nests from the last of May until late in the autumn. We should watch for the different broods and collect the larva, pupa, and adult of both sexes, as well as the workers. The cells containing the young, with whatever parasites may be found on them, may be placed in alcohol, while the mature bees may be pinned. The simplest method of collecting the nests of humble-bees is to visit them before sunrise or after sunset, when the bees are in the nest, and we can secure the whole colony. The bees can be picked up with

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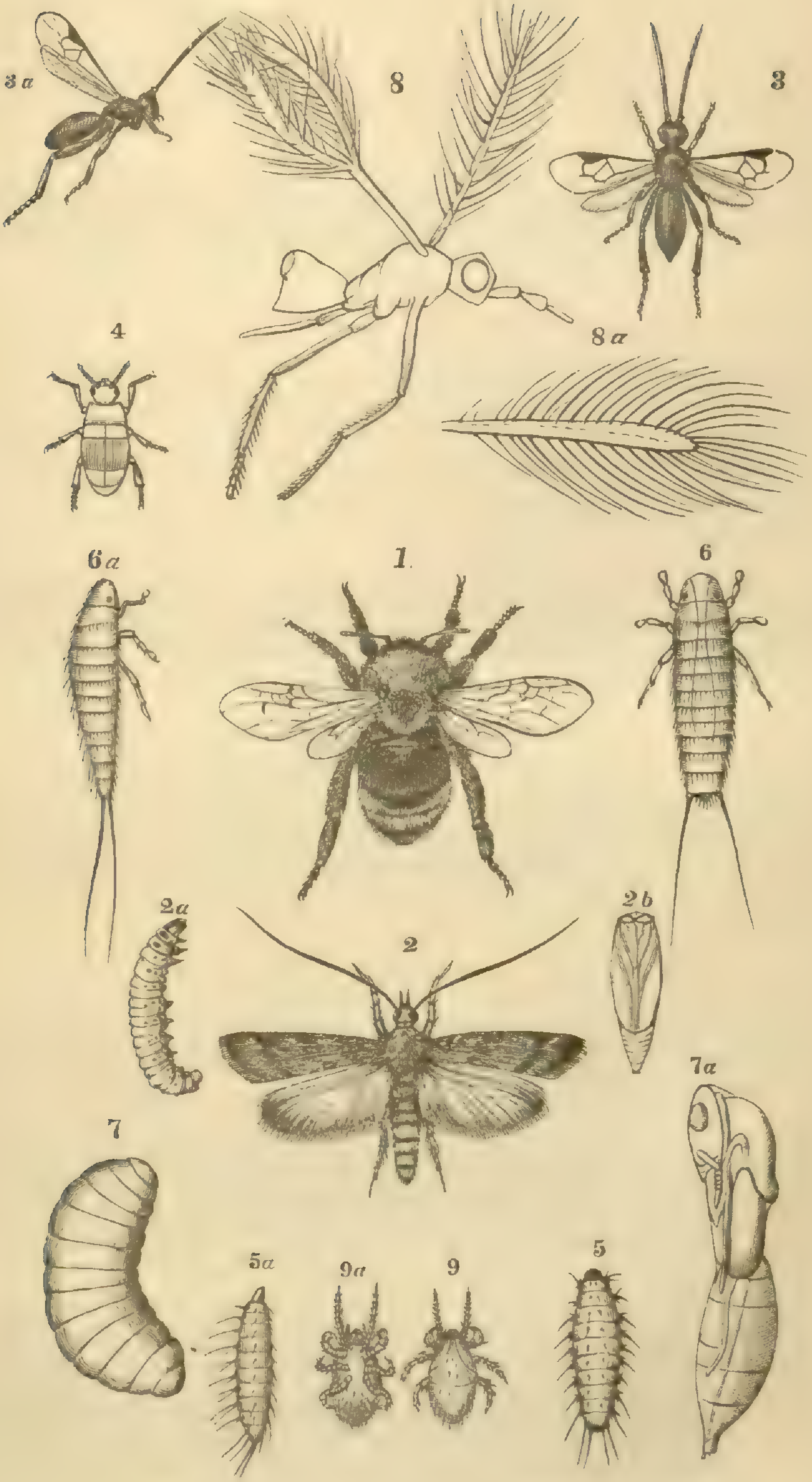

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forceps as they emerge from the nest, or caught with the net and then pinned. Refractory colonies may be easily quelled by pouring in ether or chloroform, or burning sulphur at the aperture, as is the best method of procedure with wasp's nests.

The solitary species, besides boring in the earth like Andrena and Halictus, whose habits have been described in the first volume of the NATURALIST, also bore in the stems of different plants, such as the elder, syringa, raspberry, and blackberry. Nearly fifty species of insects, mostly hymenoptera, are known in France to burrow in the stems of the blackberry alone! Now is the time to look for their burrows in the dead branches. Their presence is usually detected by an old hole at the end of a broken branch. The writer would be greatly obliged for material to aid him in the study of our bees and wasps, and would take pleasure in corresponding with those interested in the study of their habits, and would be very grateful for specimens of the young in alcohol, their parasites and nests.

REVIEWS.

VOLCANIC ROCKS.*—The author of this interesting memoir classifies volcanic rocks in five orders. The first order consists of Rhyolite with three families, Nevadite or granitic-rhyolite, Liparite or porphyritic-rhyolite, and Rhyolite proper or Lithodic and Hyaline-rhyolite. The second is Trachyte with two families, Samidin-trachyte and Oligoclase-trachyte. The third is Propylite with three families, Quartzose-propylite, Hornblendic-propylite, and Augitic-propylite. The fourth is Andesite with two families, Hornblendic-andesite, and Augitic-andesite. The fifth order is Basalt with three families, Dolerite, Basalt, and Leucitophyte.

The author confines himself in this classification to volcanic rocks of Tertiary and Post-tertiary age, which he subdivides into "massive eruptions" and "volcanic eruptions." The origin of massive eruptions is

*Principles of the Natural System of Volcanic Rocks. By F. Baron Richtofen. Dr. Phil. Memoirs presented to the California Academy of Science, Vol. I, Part 2. May 6, 1867. pp. 4, 94.

attributed to a time when the crust of the earth was thinner than at present, and opened in wide cracks, letting out vast masses of rock in a state of aqueous fusion. These are supposed to have choked up the cracks, and in the gradual consolidation which followed, only local lakes of matter were left in a state of fusion, which find their outlets in the existing volcanoes.

Both in massive and volcanic eruptions the Propylitic rocks are the first or earliest ejected, then in successive, though not invariable, sequence, the Andesitic, Trachytic, Rhyolitic, and Basaltic lavas. Active volcanoes are divided into two classes, those which still continue to eject the same material as exists at their bases in the ancient "massive eruptions," from which the author supposes they take their rise, and those grander rents which have undergone periodical changes in the nature of the ejected rocks.

Lassen's Peak in Northern California belongs to the latter class. The base is Andersitic tufa and ashes, in stratified layers nearly four thousand feet thick, and upon this currents of Andesitic lava, then trachytic lava streams succeed in elongated, sloping tables; rhyolite composes the present summit to the depth of fifteen hundred feet; and, lastly, locally separated, are inferior rents to the north which have thrown out basalt of apparently very recent origin.

Thus the periodical changes, taking place in such larger active volcanoes, correspond in the order of their succession with those exhibited by the older and more massive eruptions.

Active volcanoes may, therefore, be classified as belonging to the propylitic, andesitic, trachytic, rhyolitic, or basaltic epochs, or as arising in one of these and passing through several successive stages of development.

Thus Lassen's Peak has reproduced, during its successive changes, the structural features of existing Andesitic, trachytic, rhyolitic, and basaltic volcanoes, and also the order of succession which is observed in the massive eruptions of former periods. The author, however, candidly admits that, in some instances, the order of succession is partially reversed, as in the island of St. Paul in the Indian Ocean, where the rhyolitic rocks are overlaid by basalt, and this again by rhyolitic and basaltic rocks in succession.

Following upon this is an highly interesting discussion of the chemical composition, correlations of age and texture, correlations of age and composition, the geographical distribution, and the origin of volcanic rocks.

The extrusion of the lava is accounted for by the expansion which was consequent upon the changes of the denser rocks around the lower part of the cracks or orifices, from a solid or highly viscous state, to one of aqueous fusion.

Granite and Syenite are regarded as the product of very ancient massive eruptions, and as of wholly volcanic origin.

Though these views are so entirely novel, and even startling, and opposed in respect to the origin of granite to the results obtained by the Canadian Survey among the vast masses of granite in Canada West, it is nevertheless a philosophical essay which commands our respect from its solidity, and the evident familiarity and experience of the author with his subject. Whether the principles laid down are true or not in the general application for them claimed, this essay has unquestionably opened a new path to geological investigations.

THE VOLCANOES OF THE HAWAIIAN ISLANDS.* — This work is filled with numerous observations, many of great value, made by the author during his travels among these islands. The whole group is treated one by one in detail.

From Mr. Coan, and others resident among the Sandwich Islands, the author gathered many interesting facts with regard to the various eruptions of the volcanoes of Hawaii, and the physical geography of other members of the group.

The maps of the Kauai and main groups are original, and the crater of Kilauea, on the scale of one-half mile to the inch, is from an actual survey by Mr. Brigham, and of great value to future explorers.

One fact of general interest is, that while the Hawaiian lines of volcanoes run east and west, the major axis of their oval craters are invariably north and south, and, by comparison with the craters of eighteen other lines of volcanoes, it is found that they are generally at right angles with the axes of elevation of the different mountain chains to which they belong.

Mr. Brigham adheres to the mechanical theory of the origin of volcanoes, — "the earth's crust contracts unequally owing to its various composition, structure, and form, causing certain portions to fall below the general level, opening rents at the boundaries, and forcing up molten matter to the surface.

THE GEOLOGY OF IOWA.† — This survey, conducted by Dr. C. A. White, and his assistant, Mr. O. H. St. John, has extended over the counties to the south-west of the Des Moines River, and resulted in the discovery of two series of the Carboniferous rocks. The upper series of beds lie to the south-west of this river, attaining a maximum thickness of one hundred and seventy-five feet. A coal-bed, twenty inches in thickness, was traced along the valley of the Nodaways through the counties of Adams, Taylor, and Page. The upper series, comprising nearly all the workable coal-beds in the State, is found to the north-east of the Des Moines River. The inclination of the strata is south-west, and therefore Dr. White argues that miners in the south-western counties may expect to find pro-

* Notes on the Volcanoes of the Hawaiian Islands, with a History of their various Eruptions. By W. T. Brigham, A. M. Memoirs of the Boston Society of Natural History. Vol. I, Part 3, pp. 132, with five plates.

† First and Second Annual Report of Progress. By the State Geologist and the Assistant and Chemist on the Geological Survey of the State of Iowa. 8vo, 284 pp. Des Moines, 1868.

ductive coal-beds by shafting through the Upper Series, a result which will probably prove of great economical value to the people of this part of the State. A new feature is the publication of popular letters which were originally written for the newspapers by order of the legislature of Iowa while the survey was in progress, a plan which other States might do well to imitate, since it brings directly before the people of each county what the survey is really accomplishing for their benefit. Gypsum was found in such quantities near Fort Dodge that it has been used as a building stone. In Mills county two systems of glacial scratches were found diverging at an angle of thirty-one degrees, and about twenty miles north another system diverging from one of these ninety-three degrees. The first two "approximately coincide with the general courses of the Missouri and Platte Rivers," and the last with "the general direction of the drainage of the western watershed." The "Walled Lakes" of Iowa, a paper also published in the May number of this Magazine, is especially interesting as showing how nature, in some of her processes, may build up a structure so regular that it may be mistaken for an artificial construction. Some space is also given to descriptions of Indian mounds, usually circular in form, but thus far found to be barren of implements or other remains, and occupying the most elevated and picturesque elevations. No conjecture is made in respect to their character or the purposes for which they were intended by their ancient builders.

CALIFORNIA MOSSES.* — Professor Lesquereux remarks that "The flora of California, in all its departments, is liable to great local varieties according to the peculiar atmospheric and chemical conditions to which it is subjected. The more the phænogamic flora of that region is studied, the more the number of species is diminished."

THE VARIATION OF ANIMALS AND PLANTS UNDER DOMESTICATION.† — We have but space at present to quote from Dr. Gray's preface to the American Edition regarding this storehouse of facts, with which every naturalist, as well as agriculturist, should be acquainted.

"It is a perfect treasury of facts relative to domesticated animals and some of the more important cultivated plants; of the principles which govern the production, improvement, and preservation of breeds and races; of the laws of inheritance, upon which all organization of improved varieties depends; of the ill effects of breeding in-and-in, necessary though this be to the full development and perpetuation of a choice race or breed; and of the good effects of an occasional cross, by which rightly managed, a breed may be invigorated or improved. These and various kindred subjects are discussed scientifically with rare ability, acuteness, and impartiality, by one who has devoted most of his life to

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* The California Academy of Science (formerly California Academy of *Natural Sciences*) has begun to publish quarto Memoirs. Vol. I, Part 1, contains a "Catalogue of Pacific Coast Mosses," by Professor Leo Lesquereux. pp. 38.

† The Variation of Animals and Plants under Domestication. By Charles Darwin. Authorized edition, with a Preface by Professor Asa Gray. 2 vols. 12mo, with Illustrations. New York, Orange Judd & Co., 1868. $6.00.

this class of inquiries, and who discusses them in a way and style equally interesting and instructive to the professional naturalist or physiologist, and to the general reader. To the intelligent agriculturist and breeder, these volumes will be especially valuable, and it is in the interest of such practical men and amateurs that they are here reprinted."

Cosmos. (Weekly) Paris.—This journal, besides giving weekly reports of the proceedings of the French Academy, has a most useful summary of news in all departments of physical and natural science, including rural economy and the application of chemistry to the arts. During the past year it has published, in weekly parts, "The Comparative Geology of Meteorites," by M. Stanislas Meunier, son of M. Victor Meunier, the Editor in chief. The leading article of the present number (dated March 21, 1868) is on the general method of the immediate analysis of meteoric stones, by M. Stanislas Meunier, which is succeeded by an account of M. M. E. Fremy and Terreil's general method of the immediate analysis of vegetable tissues.

M. T. Reiset writes on the ravages of the Cockchafer, or "Hanneton" (*Melolontha vulgaris*), and its larva, the beetle of which in the spring of 1865 defoliated the oaks and other trees, while immense numbers of their larvæ in the succeeding year, 1866, devoured to a fearful extent the roots of garden vegetables, etc., at a loss to the department of the Lower Seine of over five millions of dollars. This insect is three years in arriving at its perfect beetle state. The larvæ hatched from eggs laid by the beetles which appeared in such numbers in 1865, passed a second winter, that of 1867, at a mean depth in the soil of $\frac{40}{100}$ of a metre, or nearly a foot and a half. The thermometer placed in the ground (which was covered with snow) at this mean depth, never rose to the zero point* as *minimum*. Thus the larvæ survived, after being perfectly frozen (probably most subterranean larvæ are thus frozen, and thaw out in the spring at the approach of warm weather). In June, 1867, the grubs having become full-fed, made their way upwards to a mean distance of about thirteen inches below the surface, where, in less than two months, they all changed to the pupa state, and in October and November the perfect beetle appeared. The beetles, however, hybernate, remaining below the surface for a period of five or six months, and appearing in April and May. The immature larvæ, warned by the approaching cold, began to migrate deep down in the soil in October, when the temperature of the earth was ten degrees above zero. As soon as the snow melted they gradually rose towards the surface. They began to rise February 23, 1867, when the temperature of the earth had risen a little, being + 7°. 1, the mean temperature of the soil in January being + 2°. 8.

Quarterly Journal of Science. (London.) In the April number Mr. John Mayer writes on the claims of Nitro-glycerine as an industrial agent. It has been used as a blasting material in the operations of mining, quarrying, and railway cutting for about three years. He con-

* By the Centigrade thermometer.

siders it as in reality "less dangerous than gun-cotton, gunpowder, and more completely under control than they are." "Weight for weight the new explosive is ten times more powerful than gunpowder. The extraordinary mechanical or eruptive power which it exerts is partly owing to the fact that there is no solid residue attending the explosion, and that the enormous pressure exerted by the resulting gases is due to the great rapidity of the explosions." In blasting, hard tamping is of little use, owing to its curious property of "striking down," *i. e.* exerting its explosive force almost entirely in a downward direction.—Mr. C. F. Danvers writes an interesting article on Ransom's Patent Concrete Stone. This very durable building material is made by mixing "sand, chalk, or other mineral substance with its proper proportion of a solution of silicate of soda in an ordinary pug-mill, and the mixture, which very much resembles in substance fresh putty rolled in sand, and is of a very plastic consistence, is either pressed into blocks or moulds, or can be rolled into slabs or such forms as may be desired, and is afterwards either saturated with, or immersed in, a solution of chloride of calcium, when a double decomposition of the two solutions employed immediately takes place. The silica combines with the calcium, and at once forms an insoluble silicate of lime, firmly binding together all the particles of which the stone is composed, whilst at the same time the chlorine combines with the soda and forms chloride of sodium, or common salt, which is easily removed."—Prof. G. Zaddach gives a very thorough account of Amber. It is found on the shore of the Baltic, principally at Samland, where there are "in deep-seated deposits an inexhaustible store of this valuable fossil." Amber is the gum or liquid resin of a pine tree of Eocene Tertiary age, and occurs in rolled fragments, very seldom weighing as much as half a pound, in the form of pins, drops, and plates, which were formed between the bark and the wood, or between the yearly rings of growth of the stem, and were washed from the low boggy coast into the sea, in which the crabs, sea-urchins, and oysters, associated with it, lived, the deposits in which they are now found having been formed in the mouth of a stream. With the Amber-pine flourished Camphor trees, Willows, Birches, Beeches, and numerous Oaks; and amongst the Conifers was a *Thuja*, very similar to the *Thuja occidentalis*, or White Cedar now living in this country, "next to which abounded *Widdringtonia*, Pines, and Firs in great variety. Many thousands of the first might already have perished, and, while the wood decayed, the resin, with which the stems and branches were stored, might have accumulated in large quantities in bogs and lakes in the soil of the forest. In order to explain, however, that this accumulation of Amber could be suddenly broken up, floated away, and scattered, I assume that the coast of the district was at that time on the point of sinking." Amber is torn up from its bed by storms and thrown upon the shore, "where a hundred hands are waiting to intercept it with nets;" or "the inhabitants of the coast go in boats, and, turning the stones [between which the larger pieces are

found] with hooks fastened on long poles, endeavor to discover the Amber in the interspaces, and to draw it up with small nets." This is called "striking for amber." Like the gum copal of Africa, amber is of interest to the entomologist from the insect remains it contains, some of which are figured in the second plate (from specimens selected by Mr. F. Smith, from the British Museum) accompanying the article, the first plate being a geological map with sections of the localities of Amber.—The gigantic Dragon-tree of Teneriffe is no more. Its age was estimated to be over 6000 years old.—M. Balsamo has obtained hybrids between the American and the Italian Cotton plants. He hopes to obtain a plant of the long staple form of our species (Gossypium Barbadense) which shall ripen earlier in Italy than it now does. He has also investigated the action of light on the germination of seeds. "He found by using a glass jar full of vegetable mould, that seeds exposed to the action of sunlight were greatly retarded in, if not entirely prevented from, germination. Seeds to which only yellow light had access were not affected.—Frau Lüders believes that she has proved (what many fungologists were prepared for), that *Vibriones* are produced from the spores and germinal filaments of various moulds or fungi. Vibriones were supposed to be infusoria. The learned lady believes that the blood of living animals contains *Vibriones*, but during life they are quiescent, showing no signs of life until putrescence commences. Professor Hallier, the best authority on fungi, but who does not accept Frau Lüders' results as to the connection of "moulds" and "vibriones," announces "that he has been able to isolate and identify from the blood of typhus fever patients a distinct form of fungus; also in vaccine matter and in other cases. Dr. Salisbury, of New York, has also recently made known the observation of distinct fungi in the fluids of persons suffering from other contagious diseases. Are we not advancing to a great fact as to the nature of such diseases? Fermentation and vaccination may come to mean much the same thing. Frau Lüders has also successfully shown that "yeast" may be grown from many "moulds," as first demonstrated by Hallier.—Dr. O. Fraas believes that there were formerly glaciers on Mount Sinai.—Dr. Collingwood has discovered on the shore of the China Sea an enormous blue Sea-anemone, two feet in diameter, in which little fishes take shelter. A small fish is known to inhabit the body-cavity of Holothurians, or Sea-cucumber, and also of Jelly-fishes.—Mr. Shirley Hibbard believes the culture of the Ailanthus Silk-worm in Great Britain to be a delusion. The thread is too short. An acre under culture yielded about ten shillings, and another year eight pounds, while the same space planted with potatoes yields twenty pounds; and frosts carry off the insects. The cocoons "are least in value of any silk-worm's cocoon, and are in fact almost rubbish."—Professor Kölliker has lately made the discovery of true polymorphism among coral animals (Anthozoa). Besides the usual form of sea-pens (*Virgularia* and *Pennatula*) is another, destitute of tentacles, besides other important anatomical differences.—The bodies of

various Molluscs are found to contain acids, enabling them to bore in rocks. Pholas is known to bore into gneiss (stratified granite). Two boring worms, *Leucodore* and *Sabella*, which bore cavities in limestone rocks, also contain acid.—Mr. Flower thinks there is but one species of Sperm Whale.

NATURAL HISTORY MISCELLANY.

BOTANY.

The Long Moss of the South (*Tillandsia usneoides*).—In a recent number of the Naturalist Dr. Asa Gray inquires whether this is really an Epiphyte, and gives some reasons for a suspicion it may probably be a parasite. Several times I have had fresh specimens, and fastened them on blocks,—dead blocks of course,—just as we do with Epiphytæ. Orchidæa, and had them grow as healthily as in their natural state. One I left in the Orchidæa house, at Springbrook, near Philadelphia, some years ago, had then been eighteen months on the block, and I believe was amongst the lot sold at public sale two years afterwards. Many Tillandsias, and allied genera, grow nearly as well on blocks in Orchidæa houses as in the earth.—Thomas Meehan.

In the hope of throwing some light on the question raised by Professor Gray, in the February number of the Naturalist, I offer the following facts, which fall under my daily observation, attempting, however, no explanation.

1. The Long Moss, or Spanish Moss (*Tillandsia usneoides*), grows abundantly and luxuriantly on the dead branches of our live-oaks, and other trees, but when these dead branches fall to the ground, it soon dies.

2. On a tree near my house, which has been entirely dead for more than a year, there is a thrifty growth of this moss.

3. I often find it simply hanging by a loop to a twig, or a projecting point of bark, and still growing vigorously.

4. On fallen trees, even on those recently cut down, I find it generally, but not always, withered and dead.—D. H. Jacques, *Glen Evergreen, Jacksonville, Fla.*

Long or Black Moss (*Tillandsia usneoides*) only an Epiphyte.—Concurrent testimony from several quarters makes it clear that *Tillandsia* does not perish on cutting down the tree that supports it, and that it thrives as well on dead as on living trees. Our original informant must therefore have been mistaken.—A. Gray.

Anomalous Flowers of the Willow.—There is a species of Willow (*Salix*) growing near here which has for two seasons borne the above

anomalous flowers, either a double ovary or two single ones appearing above each scale. Gray, in his Manual (p. 416), mentions a "transformation of anthers into imperfect ovaries" as common in *S. rostrata*, and occasional in other species; but this specimen has not the "yellow scales" nor the "prominently veined" leaves of that species, it is more like *S. humilis*; and besides, if this is such a transformation, and the duality of the organs seems to indicate that it is, it is a *complete* one; no intimation, excepting the duality, existing which may point to the stamens as their origin. The ovaries are full-sized and perfect, and the embryos well developed. I have specimens of the above, and also of Arethusa bulbosa, Woodwardia angustifolia, Lycopodium inundatum, Draba verna, and a few other scarce plants, which I should like to exchange for scarce plants which I have not. I should like also to correspond with two or three young botanists for the purpose of more general exchange. — W. P. BOLLES, *Box* 356, *New London, Conn.*

COMPARATIVE FLORAL CALENDAR, CASS COUNTY, MISSOURI. —

Peucedanum	in bloom,	. . . . .		Mar. 23, 1868.
Isopyrum biternatum	"	Apr. 21, 1864.	Apr. 19, 1867.	Mar. 24, "
Viola pubescens	"	Apr. 21, "	Apr. 19, "	Mar. 28, "
Erythronium albidum	"	Mar. 29, "	Apr. 2, "	Mar. 28, "
Astragalus caryocarpus	"	Apr. 27, "	Apr. 28, "	Mar. 28, "
Peach	"	Apr. 27, "	Apr. 20, "	Mar. 31, "
Antennaria plantaginifolia . . .	"	Apr. 27, "	Apr. 19, "	Apr. 1, "
Strawberry	"	May 2, "	Apr. 20, "	Apr. 2, "
Viola cuculata	"	Apr. 14, "	Apr. 19, "	Apr. 1, "
Phlox divaricata	"	Apr. 29, "	May 7, "	Apr. 2, "
Claytonia Virginica	"	Apr. 14, "	Apr. 15, "	Apr. 2, "

G. C. BRODHEAD.

WHITE WILD COLUMBINES, ETC. — In the April number of the NATURALIST, Mr. Millington mentions a white Columbine. I would state that I, also, have seen white columbines (*Aquilegia Canadensis*). During last summer I saw a very pretty white *Lobelia syphilitica*. I have also seen white flowered plants of the common ironweed (*Vernonia Noveboracensis*). — G. C. BROADHEAD.

IS THE ELDER A NATIVE PLANT? — In answer to inquiries as to the nativity of the Elder (*Sambucus Canadensis*) I would say most positively, that it is as much a native of the United States as the oak or elm. My father being one of the first settlers of Illinois, the elder was used for making spiles for tapping maple trees, and in the years 1857 and 1858, I explored a considerable part of Northern Kansas, which was then in its wild and primitive state, and the elder was always present in the valleys in connection with the wild plum, choke-cherries, etc. The elder is more plentiful in Kansas than in Illinois, and was before the white man became possessor of the soil. — WM. J. MCLAUGHLIN.

FLOWERING OF THE "GERMAN IVY."—In the March number of the NATURALIST is a communication on "German Ivy," and its "flowering under peculiar circumstances." The description given by Professor Gray is certainly very interesting and remarkable. Allow me to state that if this plant is taken in the spring and placed in the ground without a pot, then transplanted to a pot in the fall and cut down close to the roots shortly after the appearance of new shoots, flower buds, and flowers will follow. I send with this specimens of this plant which has been treated in this way, and so successful has it been, that efforts to *prevent* the plant from *blooming* have been *unavailing*, so *vigorously* does it *flower*. Is there an explanation possible why this plant and others of different species should blossom so profusely after such severe pruning?—JAMES L. LITTLE, JR.

A VARIETY OF THE COMMON AGRIMONY.—A variety of the common agrimony (*Agrimonia Eupatoria*) is occasionally found in this vicinity, having nine leaflets instead of seven, which is the usual number. In all other respects it appears to be identical with the ordinary form, except that it is, perhaps, a little taller, and occurs in rather more swampy localities.—T. MARTIN TRIPPE, *Orange Co., N. Y.*

ZOÖLOGY.

HOW SPIDERS BEGIN THEIR WEBS.—Early in the spring of 1866, while arrangements were making for photographing a live male of the *Nephila plumipes* (the so-called "Silk Spider of South Carolina"), the spider, after having several times traversed the circle of wire on which it was, suddenly stopped, took a firm position at the top of the frame and lifted its abdomen, pointing it toward a large skylight which occupied the middle of the ceiling: a slender, shining thread was seen to shoot forth from the spinnerets which occupy the end of the abdomen; it seemed to have a blunt, rounded extremity, which advanced through the air rather quickly for a few inches, but afterward more slowly and steadily, and with an upward tendency, but always in the direction of the skylight. When it had reached the length of five or six feet, I allowed it to become attached to my coat; the issue ceased at once, and the spider, having attached the end of the line, turned about and began to pull upon it. I now broke it off near the wire, and, believing that there was a current of air toward the skylight, I blew gently upon the spider from various directions, and found that it always pointed her abdomen in the direction in which I blew, and that the thread was emitted in the same direction. So that while it seemed to have the power of projecting a thread for a short distance, yet it always availed itself of the prevailing current of air.

This single instance by no means proves that all spiders do or can employ this method of bridging over spaces, and it may be that on ordi-

nary occasions they do, as every one has seen them, descend to the ground, emitting the thread as they advance, and pulling in the slack before attaching it to the desired point. But the former method enables them to cross water and to pass from tree to tree; while the well-known buoyancy of the silk permits them (or at least the smaller species) to sail along our water, hanging at the lower end of a line whose upper end is invisible.

In reference to this subject, see Kirby and Spence's Entomology, Motions of Insects, and Manner in which they take their Food." — B. G. Wilder.

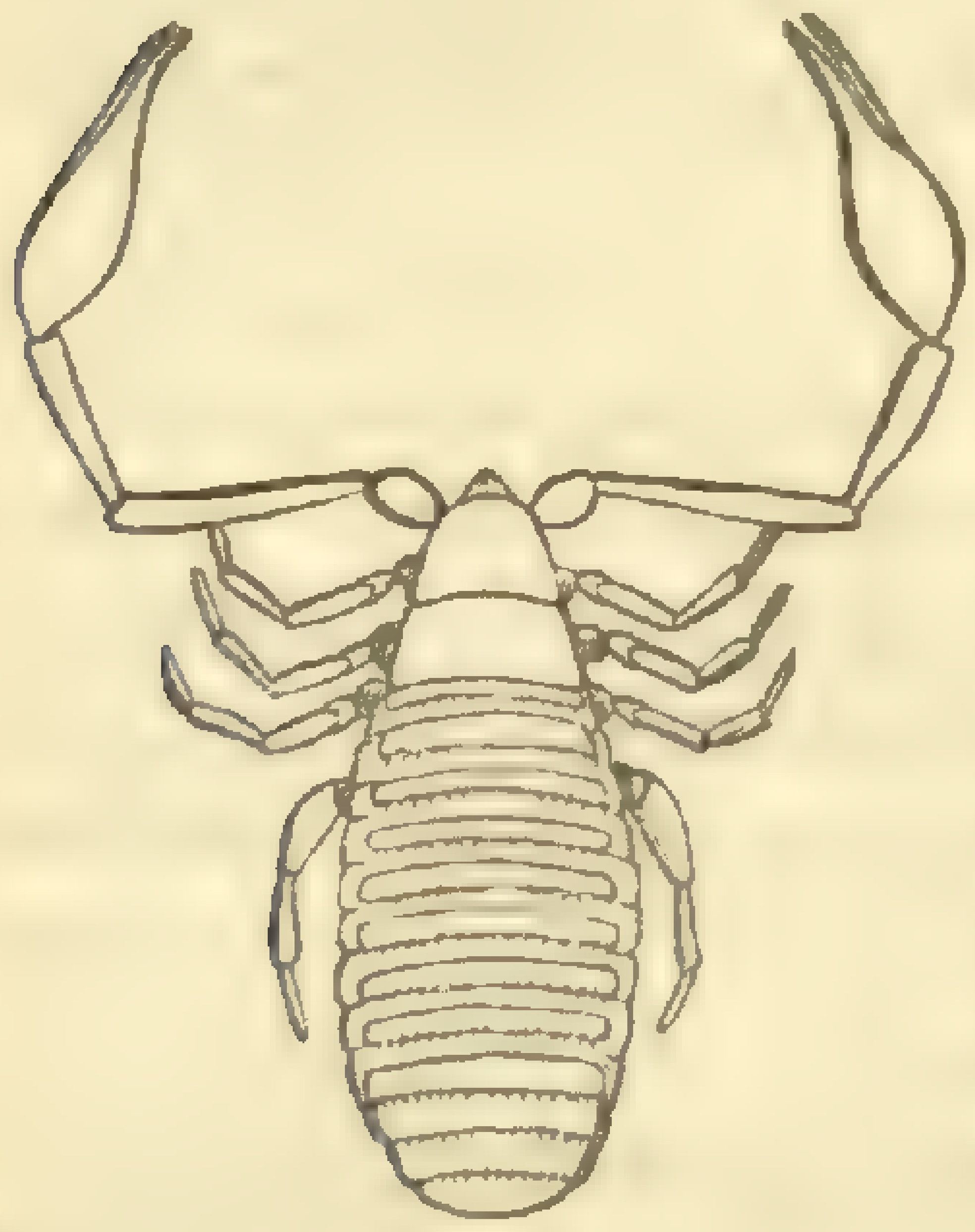
The Wolverene. — The Wolverene follows the Beaver and preys upon them; in northern latitudes, the wolverene is almost always present where the beaver is abundant. The beaver has a beaten path on the bank of the stream near his lodge. There the wolverene lies in wait for him, and often cuts short his career. A half-breed Frenchman here owns a female of the bull-terrier breed, which follows the beaver to his lodge, and pulls him out, having sometimes a severe fight, and showing ugly cuts about the head, from the beaver's sharp teeth. The Indians offer a big price (a large buffalo horse) for the dog. — D. S. S., *Fort Sully, Dakota Territory.*

The Mocking Bird. — I observe that while all the other song-birds are silent in our Southern forests and groves, the Mocking-bird is quite as musical as during the spring and summer. Several of them are singing on the topmost twigs of the oaks near my house most of the day. More than a dozen pairs of them built their nests within sight of the dwelling and out-buildings during the past spring and summer, all of them laying twice, and some three or more times. Few, however, succeeded in rearing their young, many of them being destroyed by snakes, and more by the persistent, but generally unsuccessful, attempts of the ladies of the family to domesticate them. Their first nests were invariably built in low bushes or on fences, but if these were disturbed, either before or after the hatching of the young, the parent birds, as if taught by experience, always built on trees, peach-trees being preferred. They came boldly to the house, and even into the rooms where we were sitting, to feed the young we had taken from them. — D. H. Jacques.

The Dragon Fly. — Three years ago, in the middle of the summer, I was sitting in my tent, in camp, on the old battle-ground below New Orleans, when my attention was attracted by the swift flight of a large Dragon-fly, closely pursued by another of the same size. Twenty-five yards from my tent the fugitive was overtaken, and both fell to the ground together, tumbling over and over. I walked immediately to the place, and observed that in that very short time the creature had bitten his victim entirely in two, in the articulation just forward of the front wings, and had settled complacently to eating the body, commencing at the part he had bitten through. The head, thorax, and legs retained life, struggling and kicking vigorously during several hours I had the

opportunity to observe them. I will remark that the stagnant lagoons of Louisiana, and perhaps the abundant food, develop dragon-flies of a very large size. In view of the pest of musquitoes, it is a pity the great insect-eater is not still more abundant.—D. S. S.

THE FALSE SCORPION.—These little scorpion-like animals are intermediate in structure between the mites and the spiders. We figure *Chelifer cancroides* L. kindly identified by Dr. Hagen, of the Cambridge Museum, who has studied our American species. He states that it seizes the legs of flies, and is thus transported about by them.



"The fact that an animal changes its location by means of another animal is interesting, and it is evident that this way is taken either from laziness, or from incapacity to accomplish his purpose in any other way. In the *Chelifer*, whose movements are slow, this means of locomotion is apparently adopted to find suitable food more easily. Necessarily such a state of things cannot be unique in natural history. I confess that at present I know nothing analogous to it among insects except the case of the larva of *Meloë*, the well-known *Triungulinus*, which creeps upon bees on purpose to be taken into their nests. Something analogous exists, I think, among fishes. *Echeneis remora* is often found attached to other fishes by a peculiar apparatus. But the purpose in the *Echeneis* is not very clear, for this species swims very quickly. The apparatus for the attachment of *Cyclopterus lumpus* is quite different; its purpose is not known."—HAGEN.

The False-scorpion is about a quarter of an inch long, and may be observed moving with a curious sideways gait on opening old books, and in dusty places generally. It is said to hunt the flea vigorously, and also to devour the *Atropos*, or little white book-louse. It has also been found lurking under the elytra, or wing-covers of beetles, but it does not seem to be truly parasitic in its habits.

THE JACK-SNIPE.—While gunning one day on Jordan Creek, Lehigh county, Pennsylvania, I saw four little birds running along ahead of me until they came near some clumps of grass, when they ran under the edges and hid themselves. I also, at the same time, saw one of the parent birds fly away. I caught one of the little fellows and examined him; he was about two or two and a half inches in height, of a light bluish-gray color above, and lighter on the breast; color of bill yellowish pink; eyes brown; legs greenish black.

The female (as it turned out to be) soon came and took up a little bird and carried it about one hundred yards to the mill-race. I should say flew with her load, as it seemed to me rather a great one for the old bird. She soon returned, and took up a second, flying off with it; and so the third and fourth. I then went to see where she had taken her family, all

found them in a nest of thin sticks and soft grasses on the ground, about two or three feet above the water as it made its exit from the mill. The nest was also near the mill, close to the water-wheel, near to where the water shot over the wheel. I shot the female, and I afterwards saw that the male bird was attending them as the female had done. It was the female and young of *Tringa maculata*. — WALTER J. HOFFMAN, *Reading, Pa.*

THE LOCUST KILLER. — I never saw but one of these wasps, and that was about two years ago, and then only for a few moments. It appeared to be marked almost, if not precisely, like a "hornet," and to be about two or two and a half inches in length, and large in proportion; truly a most formidable looking insect. The "killer" had seized one of our August locusts, and was endeavoring to rise from the ground with it, the locust clinging to the grass, and fluttering and screaming all the while. Before I could seize them, they rose from the ground and made off in a bee-line, at a height of about twelve or fifteen feet, the locust resisting with might and main. I am told they make nests in the ground, boring a hole to the depth of two or three feet. They must be rare, or I should have seen them before. — C. W. TAYLOR, *Hulmeville, Pa.*

The wasp is, probably, the *Stizus speciosus*, which seizes the Cicada to store its nest with, which is, probably, not more than a foot in depth. We hope our correspondent will observe its habits more closely, and send us specimens so that it can be identified with certainty. — EDS.

THE PRAIRIE DOG. — Among my observations on the prairie, I have learned that the prairie dog has a very destructive enemy in the Lynx, or American Wild-cat. This quick and fierce animal hides in the grass in the outskirts of the dog-town, and pounces upon any unlucky dog that starts out to forage, and carries him off before he can whisk his funny little tail. — D. S. S.

THE ROBIN AT FAULT. — A remarkable instance of the lack of the "bump of locality" in birds came under my observation some years ago. I had nailed a board of moderate width under the eaves of a barn to form a resting-place for the nests of the Cliff, or Jug-swallow. It was inclined at an angle so as to form a sort of trough. A robin commenced building her nest in it, but seeming unable to fix upon any particular spot, deposited the mud and straw along the entire length of the trough, about ten feet. After working several days, she abandoned her task. Shortly afterwards I saw a robin (whether the same bird or not I cannot say) attempting to build her nest in the same way, along the entire outer cornice of a house, about thirty feet. — A. P. R., *Geneva, N. Y.*

A VARIETY OF THE BLACKBIRD. — I suppose that almost every one is well acquainted with the general appearance of the Red-winged Starling, or Blackbird (*Agelaius Phœniceus* Vieillot). Last May I shot, near Fresh Pond, in this vicinity, one of these birds having a crescent-shaped mark, of a bright orange-color on the breast; this was about equal in size

and form to the half of an old-fashioned copper cent, and the feathers were colored nearly to the roots. In other respects the bird was precisely similar to the ordinary male of this species. — WILLIAM BREWSTER, *Cambridge, Mass.*

THE BELTED KINGFISHER. — I observe a note concerning the nesting of the Belted Kingfisher in your November number, in which Mr. Fow[illegible] differs from Mr. Samuels. I now propose to be a connecting link between the two, and to say that I have *always* found the holes of *C. alcyon* "[illegible] or eight feet long," as Mr. S. says, and *always* "in the form of an elbow" as Mr. F. describes them; and that I have sometimes found a bed of sticks, grass, etc., and sometimes not. I wish, too, to ask if any one [illegible] ever known them to turn to the left, as I have never seen them branch otherwise than to the right. — W. E. ENDICOTT.

THE DWARF THRUSH IN MASSACHUSETTS. — A single specimen of the Dwarf Thrush (*Turdus nanus* Aud.) was obtained in Waltham, Mass., [illegible] Oct. 9, 1867. It was taken by Mr. L. L. Thaxter, and its identity was first discovered by Mr. C. J. Maynard, of Newtonville, Mass. The bird was found in high, dry woodland, not in a swampy locality, such as [illegible] nearly-allied species frequent.* — E. A. SAMUELS.

GEOLOGY.

THE BONE CAVES OF BRAZIL AND THEIR ANIMAL REMAINS. By Prof. J. Reinhardt. — The distinguished author, well known to zoölogists [illegible] his numerous and valuable contributions to the history of mammals (especially Cetacea), Birds, Reptiles, Fishes, etc., has favored one of the popular scientific journals † of his country with a detailed and very interesting account of "The Bone Caves of Brazil and their Animal Remains" — a subject on which Professor Reinhardt, through his repeated travels in that country and his familiarity with its recent and Post-pliocene fauna, ‡ must be regarded as one of the first authorities. In the [illegible] that one of the many popular scientific journals of England will pro[illegible]

* The following description of this bird corresponds essentially with that of Pacific spe[illegible] given by Professor Baird: — Upper mandible of bill, black; lower mandible, at the base [illegible] half its length, yellow; at the tip, black, gradually fading into light brown towards the [illegible] the head above, and the back to the rump brownish-olive, becoming paler on the rum[illegible] upper tail coverts, which are rufous; tail, both above and beneath, with a decided [illegible] tinge, not rufous, as with T. Pallasii; chin, throat, and breast, pale buff, each feather [illegible] tip marked with a large triangular spot of dark brown, which spots are less decided [illegible] breast; sides grayish brown; belly and lower tail-coverts, pure white: on opening the [illegible] the broad buff band across the whole width within appears, as with T. Pallasii, but is [illegible] paler; iris brown; feet and tarsi paler brown; tail more rounded than T. Pallasii. Leng[illegible] breadth, 10.56; wing, 3.40; tail, 2.80 inch. The stomach was filled with small insects, pr[illegible] beetles.

† Journal of Popular Science, Edited by C. Fogh and Dr. C. F. Luetken, Copenhagen. [illegible]

‡ Dr. P. W. Lund's collections from the Brazilian caves in the Museum of Copenhagen [illegible] intrusted to the care of Professor Reinhardt.

its readers the pleasure of becoming acquainted with his memoir *in extenso*, through a translation, we shall here restrain ourselves to giving, in the author's own words, the general conclusions with which he sums up the most important results of his careful studies on the subject.

1. During the Postpliocene epoch Brazil was inhabited by a very rich mammalian fauna, of which the recent one might almost be said to be a mere fraction or a crippled remnant, as many of its genera, even families and suborders, have vanished, and very few been added in more recent times.

2. During the whole postpliocene epoch the Brazilian mammalian fauna had the same peculiar character which now distinguishes the South American fauna, compared with that of the old world: the extinct genera belonging to groups and families, that this very day are peculiarly characteristic of South America. Only two of its genera, the one extinct (mastodon), the other still living (the horse), belong to families that in our epoch are limited to the Eastern hemisphere.

3. All the mammalian orders were not in the same degree richer in genera in former times than now. The Bruta (Sloths, etc.), Pecora (Horse, Sheep, etc.), Proboscidea (Elephants), and lastly the Feræ have relatively suffered the greatest losses. Some orders, for instance the Chiroptera (Bats) and Simiæ (Monkies), perhaps contain even more genera now than formerly.

4. The Postpliocene mammalian fauna of South America differed much more from the modern one, and was especially more rich in peculiar, now extinct, genera, than the corresponding fauna of the old world.

5. The scantiness of great mammalia, one might say the dwarf-like stamp impressed upon the South American mammalian fauna of our day, compared with that of the Eastern hemisphere, was much less distinct, or rather failed altogether in the prehistorical fauna. The Postpliocene Mastodons and Toxodonts of Brazil, its many gigantic Armadillos and Sloths, could well rival the Elephant, Rhinoceros, and Hippopotamus, which, during the same period, roamed over the soil of Europe.—C. F. LÜTKEN, *Copenhagen*, *Feb.* 14, 1868.

ENTOMOLOGICAL CALENDAR.

IN June we have found that beautiful butterfly *Militæa Phaëton* rising from the low cold swamps. Its larva (Fig. 1) transforms early in June or the last week in May, into a beautiful chrysalis (Fig. 2). The larva hybernates through the winter, and may be found early in spring feeding on the leaves of the Aster, the Viburnum dentatum, and Hazel. It is black and deep orange-red, with long thick-set black spines.

The Currant-borer, *Trochilium tipuliforme*, a beautiful, slender, agile,

deep-blue moth, with transparent wings, flies the last of the month about currant bushes, and its chrysalids may be found in May in the stems. The ravages of the Currant-moth, *Abraxas? ribeāria*, begin soon after the leaves are out. Among moths, that of the American Tent-caterpillar flies during the last of June and July, and its white cocoons can be detected under bark, and in sheltered parts of fences and outhouses.

Fig. 1.

Fig. 2.

Among others of the interesting family of the Silk-worms, Bombycidæ, are Lithosia, Crocota, and its allies, which fly in the daytime, and the different species of Arctia, and the white arctians, Spilosoma, and Leucarctia, the parent of the Salt-marsh Caterpillar.

Many Leaf-rollers, *Tortrices*, are rolling up leaves in various ways for their habitations, and to conceal them from too prying birds: and hosts of young Tineans are now mining leaves, and excavating the interior of seeds and various fruits. Grape-growers should guard against the attacks of a species of Tortrix which rolls the leaves of the grape, and of a Tinean, probably a species of *Gelechia*, which, according to Mr. M. C. Reed, of Hudson, Ohio, "in midsummer deposits its eggs in the grape; a single egg in a grape. Its presence is soon indicated by a reddish color on that side of the yet green grape, and on opening it, the winding channel opened by the larva in the pulp is seen, and the minute worm, which is white with a dark head, is found at the end of the channel. It continues to feed upon the pulp of the fruit, and when it reaches the seeds, eats their interior; and if the supply from one grape is extinguished before its growth is completed, it fastens this to an adjoining grape with a web and burrows into it. It finally grows to about one half of an inch in length, becomes brown, almost black, the head retaining its cinnamon color. When it leaves the grape it is very active, and has the power of letting itself down by a thread of silk. All my efforts to obtain the cocoons failed until I placed fresh grape-leaves in the jar containing the infested grapes. The larvæ immediately betook themselves to these, and, cutting a curved line through the leaf thus), sometimes two lines thus ( ), folded the edge or edges over, and in the fold assumed the chrysalis form. From specimens saved, I shall hope to obtain the perfect insect this season, and perhaps obtain information which will aid in checking its increase. Already it is so abundant that it is necessary to examine every bunch of ripe grapes, and clip out the infested berries before sending them to the table. A rapid increase in its numbers would interfere seriously with the cultivation of the grape in this locality."

The Rose-beetle, *Macrodactyla subspinosa*, appears in great abundance. The various species of *Buprestis* are abundant; among them are

Peach-borer. *Dicerca divaricata*, found flying now about peach and cherry trees; *Chrysobothris fulvoguttata*, and *C. Harrisii*, about white pines. The large weevil, *Arrhenodes septentrionalis*, which lives under the bark of the white oak, appears in June and July. The Chinch-bug begins its terrible ravages in the wheat-fields. The various species of *Chrysopa*, or Lace-winged flies, appear during this month.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Academy of Natural Sciences. *Philadelphia, Feb.* 6, 1868. (*Conchological Section.*)—A paper was read by Dr. James Lewis on the distribution of shells in some parts of New York. Mr. W. M. Gabb remarked on shell collecting in Lower California. Dr. Beadle spoke on the great abundance of *Helix desertorum* in the deserts of Sinai.

March 5.—Dr. E. I. Nolan spoke of the irridescence of *Latirus prismaticus*. This shell, when immersed in water, exhibits a beautiful irridescent display of colors, purple predominating, on the entire surface. On microscopic examination he had found that the surface was everywhere covered with an exceedingly fine network of lines, and suggested that the expansion of these lines in water might so decrease the spaces between them as to cause the rays of light falling upon the surfaces to be refracted, thus producing the irridescence observed.

Boston Society of Natural History. *November* 6, 1867.—Dr. B. G. Wilder made some remarks upon the want of perfect symmetry in the leaves of elms and hop-hornbeams. Professor Agassiz brought forward the results of an examination of the skulls of the American bison and the European aurochs. By means of specimens exhibited, he pointed out the distinctions he had noticed in the two skulls, and stated that these differences were such as to characterize them clearly as distinct species. Professor Agassiz also exhibited the skull of a species of dolphin new to America, discovered upon the coast of Nantucket. The animal was sixteen feet in length.

Nov. 27.—Mr. S. H. Scudder exhibited a curious specimen of "walking-stick" found in this vicinity. One of the fore-legs had been lost in early life and replaced by a new one less than one quarter the length of the other fore-leg. Mr. Trouvelot states that this replacement of the leg can only take place previous to the third moult; the leg was almost perfectly formed, although one of the tarsal joints was wanting, and the foot was unprovided with claws or the usual foot-pad.

Among a number of interesting specimens, Mr. F. G. Sanborn exhibited a dragon-fly with a singular malformation or arrest of development in one wing,—the outer half being abortive,—and the cast-off skin of a young grasshopper impaled on a needle of pine. Specimens like the last were frequently found on leaves of pine or blades of grass, the leaf passing

through the head and out at the back of the insect. As the head always points towards the base of the leaf, Mr. Sanborn believes that when the insects wish to rid themselves of their exuviæ, they perch themselves upon a blade of grass or needle of pine, and, thrusting their heads against a contiguous leaf, force the skin backward. He exhibited skins of the plant lice, which, although very minute, had been emptied of their contents by internal parasites. After the transformation of the parasite it had gnawed a nearly complete circle through the dry skin, thus partially detaching a nearly rounded lid or cover through which it could make its escape.

Two of the most curious specimens exhibited were acorn cups which had been used by spiders; in one, the opening had been flatly roofed over with a web, leaving only a small aperture for ingress and egress; in the other, the cup was closed by a finer web with no opening whatever: when examined, neither spider, young, nor eggs were discovered within: this was probably an instance of a curious instinct which leads barren spiders to expend much time and labor in preparing for an imaginary progeny.

Dec. 4.—The Secretary read a paper by Mr. A. S. Bickmore, giving some notes of a short tour on the island of Yesso, Japan.

Dec. 18.—Dr. Pickering referred to Mr. Bickmore's paper on the Ainos, read at the last meeting. He said he had been struck by the description of the treatment of the dead among this people, as similar practices prevailed among the North American Indians; this, he thought, pointed to a common descent. To strengthen his argument, he endeavored to show that the *Ginseng*, or panacea of the Chinese, was obtained from a plant which only grew in the valley of the Ohio; in this case, close communication by the way of the Aleutian Isles must have taken place between the two nations.

The Rev. Mr. Perry read a paper upon the red sandstone of Vermont, and its relations to other rocks. Mr. Perry claimed that the red sandstone was the equivalent of the Potsdam sandstone of the New York geologists, and that the adjacent formations to the eastward were not highly metamorphosed rocks of a more recent period, as has been constantly asserted, but were older than the red sandstone, and lay unconformably beneath it.

Professor Agassiz stated that he had recently been reviewing the Siluroid fishes for the sake of illustrating the definitions he had long since presented for the different categories of structure among animals. The Siluroids had always been considered a natural group; placed, at first, in a single genus which was subsequently divided into two, they were next considered a family including several genera, and finally an order, embracing several groups termed families. Was there then no meaning in the terms genus, family, order? Professor Agassiz urged strongly that the application of these terms should be uniform, since a genus really remains a genus no matter how numerous its subdivisions. He believed that *orders* were founded upon degrees of complication of structure, and *families* upon the forms of animals.

Professor Agassiz claimed that the group was an order of Ganoid fishes which should be placed between the sturgeons and garpikes: they had one striking feature in the structure of the jaws, not only reptilian, but bird-like; this was the power of sliding the palatine-bone forward. The brain greatly resembled that of a sturgeon. Four families were mentioned belonging to the order.

Jan. 3.—Mr. George L. Vose read a communication on the flattened and distorted pebbles in the conglomerate near Rangely, Maine. He reviewed the different theories accounting for their form, and exhibited drawings and tracings taken from the stones themselves. He endeavored to show that the changes had occurred when the pebbles were hard, and not necessarily, as urged by Dr. Hitchcock and son, when in a plastic condition. This was best shown by a tracing of one pebble which had been bent over another, and exhibited lines of fracture converging toward the point of resistance, with an abrupt depression of the central portion of the overlying pebble.

Jan. 15.—The Secretary read a paper by Mr. A. M. Edwards, of New York, in which the author attempted to show that the division of the Diatomaceæ into fixed and free genera, was unnatural. He believed that all of these microscopic organisms were free during one portion of their lives, and adherent during another.

Feb. 5.—Dr. T. M. Brewer read a paper on the house-sparrow of Europe, defending it from the charge of destructiveness alluded to in a recent communication by Dr. Pickering. He showed that all the best English ornithologists were either silent on this point or satisfied that the bird did far more good than harm. He read an extract from the report of a commission to the Senate of France, furnishing very strong evidence in favor of the usefulness of the sparrow, and showing that at least one half, and sometimes almost all of its food consisted of destructive insects. The report farther stated that wherever the sparrow had been unwisely banished, injurious insects had immediately increased to such an extent as to become a calamity, destroying crops. In Hungary, Bavaria, and different districts of France, the sparrow had been introduced and stringent laws passed for its protection. One instance was cited where the brood of a single pair had been known to destroy over seven hundred cockchafers. Dr. Brewer said that the sparrows, recently introduced into New York and the neighboring cities, had cleared the trees of measure-worms so successfully, that, in 1867, the foliage was not known to have been entirely destroyed on a single tree. The birds are already regarded with great favor in New York; commodious, thatched houses have been constructed for them, and, in some of the parks, they are regularly fed.

Great expectations are formed in regard to the services they will render in this country, not only in keeping down the measure-worms, but in destroying canker-worms, caterpillars, and possibly curculios.

NOTE.—We regret that we cannot report more fully the meetings of Scientific Societies. We cannot give the titles of every paper read, or abstracts of all the remarks made, but only those of the most general interest.

Dana Natural History Society. — We had hoped before this to have found space to notice the good work being done by Mr. A. J. Ebell, who is now lecturing before various educational institutions, and also establishing numerous chapters of the Dana Natural History Society. The Raritan chapter, established at Matawan, N. J., held its first regular meeting at Glenwood Institute, Nov. 4, 1867, when Rev. Samuel Lockwood, a contributor to the Naturalist, delivered a lecture on the study of Natural History.

The Dana Natural History Society of the North-west College, Evanston, Illinois, have received a number of additions to their Museum begun by selections from Mr. Ebell's cabinet. A lecture was delivered on March [illegible], in the college chapel, by Mr. Ebell, the proceeds of which are to increase the Museum and Library.

CORRESPONDENCE.

J. W. C., Cheyenne, Dakota. — The snails sent were *Helix Cooperi*, a species peculiar to California and adjacent territory.

C. S. M., Jamaica Plains, Mass. — The name of the shell of which you send a pencil sketch is *Natica heros*. You will find a description of it in Gould's Invertebrata of Massachusetts, p. 231. The work you will find in any public library.

E. H. J., Pawtucket, R. I. — Papers and descriptions of American shells are scattered through the proceedings of the various Scientific Societies. Binney's Terrestrial Mollusca will cost $30 or $35. Gould's Invertebrata of Massachusetts, though published nearly thirty years ago, is the best work on New England Shells. A new edition, with all the species illustrated, will be out in the course of a year. As for fresh-water Aquaria, the experience you will gain by a few patient attempts at stocking one will be worth more than all the books. Be careful not to have too many animals in one tank.

Anon.,* Pen Yan, N. Y.—"The English Cyclopædia," by Charles Knight. Natural History, in five volumes, 4to. London. Baird's "Cyclopædia of Natural Sciences." "An Expository Lexicon of above 50,000 ancient and Modern Scientific Terms," by R. G. Mayne. London (Churchill). £2 1s. 8vo. "Dictionary of Terms used in Geology, with their Derivations," by D. H. McNicholl, M. D. Small 8vo. 12s. (Reeve & Co.) The two last give the derivations.

BOOKS RECEIVED.

Journal of the Franklin Institute, Philadelphia. January—May, 1868.
The Field. April 12, 19. London.
Cosmos. March 28, April 4, 11. Paris.
Chemical News. May. New York.
Land and Water. March 7-28. London.

* We cannot hereafter notice any anonymous communications.

THE

AMERICAN NATURALIST.

Vol. II.—JULY, 1868.—No. 5.

SEA-WEEDS.

BY JOHN L. RUSSELL.

ONCE, the plants which grow in the sea were considered of no value, and therefore were called weeds; a term applied to all kinds of vegetation which interferes with the regular crops of the agriculturist. Later and better inquiry had from time to time exhibited the immense value of these sea-plants; but the term, in its odious signification, remains attached to them, as does likewise the classical name which botanically expresses this family, the ALGÆ of Jussieu, and the *Alga vilis* of the great and familiarly read Latin poet.

It would be impossible to state definitely the number of kinds of sea-weeds to be found in the waters of the globe, and every year adds some quite new to science, either in difference of form or else in specific points.

The Algæ belong to a vast order of plants known as flowerless: but only so, because the organs which are large and prominent in most other plants, are in these rudimentary and minute, requiring the most patient research with the microscope to detect them.

Yet notwithstanding the difficulty of finding the floral parts of these so-called flowerless plants, there are portions of the sea-weeds which bear, at certain seasons of the year,

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little bodies containing definitely formed granules which answer for seeds; and on these characters, varying in each genus, the study and arrangement of the several species to a great degree depends. It is obvious, then, that colored plates, or even dried specimens, would be of little value in determining our native species, unless something more than a mere comparison of their external aspect was made.

The sea-weeds have no roots, many float upon the surface of the ocean, and others, firmly affixed to the bottom or to stones and shells, are only anchored for security; their nourishment being derived from the atmosphere, and from the water in which they are periodically or continually immersed.

The narrow and threadlike, or it may be the broad and thickened plant, equally consists of a frond, a word derived from *frons* (Latin), meaning leaf: this frond may be simple or undivided, or cut into many coarser or finer portions, sometimes with great beauty. The color of the frond is usually either green, olive or black and red, varying in intensity, the most beautiful being the different shades of red; those with the paler tints, or with yellow and white, being partially bleached and in an incipient stage of decay.

What we notice in terrestrial vegetation as we ascend from the level of the sea to the summit of mountains, in the belts or zones of plants, certain species growing only in certain conditions of temperature, we can find reversed in the sea-weeds, the finer and more beautiful kinds growing only in deep water, and where the temperature is uniformly low and cold. Collectors of sea-weeds, accordingly, avail themselves of the dredge, or of low tides, or of fierce storms, by which latter agency the deep-water species, torn from the bottom, are cast upon the shore.

If we should visit the rocky coasts of Massachusetts, at Nahant, Swampscot, Marblehead, Cohasset, etc., etc., we should find the shallow pools made by the receding tide filled with the following kinds of Algæ, which, as some are little noticed, may be worth looking at.

Coating the surface of the wet rocks, like a short pile of green velvet, grows the *Calothrix scopulorum;* tread warily upon it lest you catch an unpleasant fall from its sliminess; it will reward you if looked at through the microscope. The surface of the rocks where it shows beneath the water is rich with crimson, owing to the *Hildenbrandtia sanguinea*, a species which I detected in company with a submarine lichen, a dark olive-green crustaceous species, the *Verrucaria maura*, the former being unknown to Professor Harvey as a North American plant when he published his Nereis Boreali-Americana, which describes our sea-weeds. In similar tide-pools I found, at Marblehead near the fort, the singular *Peysonella orbicularis;* and on smooth pebbles under the water, circular patches of a pale-pink crust, which are the *Melobesia*. These, cut with a sharp knife into very thin slices across the warts which rise from the surface of the patches, will show, when magnified, the seeds lodged in minute cavities and the cellular structure of the frond. Lining the sides of these basins are the pretty coral sea-weeds, which fade so soon after drying, once thought to be, and described by Lamaroux, as animals, but now known as lime-bearing sea-weeds (*Corallina officinalis*), the actual frond being covered with a calcareous crust, which the plant has extracted and secreted from the sea. Throw a tuft of it into some diluted muriatic acid, the plant within will be revealed! The seed-vessels are elegantly formed, urn-shaped, but closed caskets, on the very tips of the branches.

Here also grow the glossy green *Cladomorpha*, and the fistulous, swollen *Enteromorpha*, both of many kinds; and where the water is brackish, like the broad overflowed ditches on the salt-marsh in rear of the beach, may be seen in vast floating masses, smooth and slimy, or bullate and bladdery, of a pale yellow-green tint in the sun, and white and like paper when lying dry and dead on the grass, the *Conferva flavescens*, which, taken up by the winds and

transported far into the interior, as once in Europe, was collected on falling in a rain-tempest, and deposited in some royal museum as meteoric paper! Rising with stiff, bristly, and sharp-pointed and jointed dark-green filaments, may be seen, in the deeper and colder tide-pools, the *Chætomorpha melangonium*, looking rich and inviting to the eye; and, lining the bottom, may be detected the dwarfer forms of the Carrageen, or *Chondrus crispus*, and its relative and neighbor the *Gigartina mammillosa*, with its channelled, forked, lobed frond, the segments often covered with tubercules, the color a rich dark purple, becoming, like the carrageen, of the same horny stiffness when dry. Sometimes among the rocks, but oftener lying upon the soft mud, are the beautiful shining smooth green *Ulvæ*, or Laver, of which there are two or three kinds; the seeds are to be looked for in the very substance of the fronds, arranged in fours; one, the *U. latissima*, or oyster-green, grows upon the shells of oysters, and may be frequently seen on piles of living oysters in the market. Served with lemon-juice, it is employed as a salad, and esteemed by the Chinese as salubrious. Hanging on piles and piers in a flaccid, drooping way when the tide is out, but bravely flaunting its gay, rich purple banners to the rushing and incoming return of the sea, is the *Porphyra*, or purple Alga, which I have seen finely luxuriant at East Boston ferry dock, and elsewhere.

A most interesting order of the sea-weeds is the Siphonaceæ: green, or else coated with lime, the fronds very variable in form, but made up of hollow, inarticulate filaments, belonging to our warmer seas, but represented in the little feathery *Bryopsis plumosa*, found near Quincy, and given me by my friend, Miss Brewer, of Boston,—something worth looking after on the narrow leaves of the sea-wrack, or Zostera.

The ribbon leaves of this plant, familiarly known as Eel-grass, is often prettily speckled with small patches of a hard thin scale, of an irregular outline. Any one of them care-

fully detached from the leaf, and magnified five hundred diameters, will show a specimen of rare elegance, a sort of shell-like body with three or more lobes, and regularly made up of a great many, somewhat square cells. It is the *Hapalidium phyllactidium* of Kutzing, detected by me a few years ago, and till then new to our flora, but discovered first by Professor Allman in Dublin bay, Ireland.

On the perpendicular faces of the larger rocks, and completely covering the rounded and erratic ones near the beaches, and also on the stone-walls and piles of the wharves, grow the several *Fuci*, whose seeds are to be searched for late in the autumn and on the beginning of winter, lodged in rounded imbedded cells, and of much beauty. The Fuci have a wide geographical distribution, growing very far towards the north pole, and known quite far southwards. According to Professor Harvey the deficiency of species is a very marked feature in our coasts, two only, the *vesiculosus* and *nodosus*, or the bladder and the knotted fuci occurring, and these quite limited in range. It were somewhat rash to differ from such high authority, yet it seems to me more than probable that some of the other European representatives, such as *serratus*, for instance, may be found; and small forms which grow on the hard and compact gravel at high-water mark, which always remind me of *caniculatus:* in confirmation of which a few specimens of fuci, collected and named by Desor in 1850, near Boston, and presented me by my friend, Miss H. B. Stevenson, are now lying before me, indicating an agreement in the same direction. Rising and falling in the surf as it dashes against the rocks, these species seem instinct with sensitive life, and appear to shake themselves in the cool water as if refreshed after partial desiccation and lassitude, while shoals of the smaller fishes and crustaceans dart in and out in security among their exuberant tresses.

To this order belongs the interesting Gulf-weed (*Sargassum*), one species of which floats in vast beds around the

island of Nantucket, and on the yielding surface of which may be seen the blue-eyed Pecten, the common scallop of our coasts, skipping along by opening and closing its valves. I have never met with any kind of gulf-weed in our waters, but some are found on the shores of Rhode Island, of which a beautiful and delicate species was discovered by the late and distinguished Professor Bailey, and dedicated to the great French botanist, Montagne.

Somewhat resembling it is the *Cystoseira*, a genus belonging to the European seas, and "scarcely represented in the New World," the *expansa* being detected in California, more delicate in its character, the frond much divided, the branches so converted into air-vessels, or vesicles, as to look like strings of beads. Here also belongs the Sea-thong (*Himanthalia lorea*), a marvellous plant, which at first grows like a cup, and which expansion is in reality its frond, and when ready to bear seed, throws out from its centre several branching linear straps, which extend from ten to twenty feet in length, although only less than an inch wide. It must be sought for at the very lowest tides, or by the dredge, and although attributed to the coast of North America by Agardh, has hitherto escaped the observation of our botanists.

In such situations, and even at greater depths, occurs the *Desmarestia aculeata*, in long tufted bundles of a dark olive-green color, usually gathered and preserved in its autumnal and winter form, when it loses the delicate and fresh growth it had in warm weather; so different, that it is often considered two distinct species. It may be known by its spine-like branchlets, although soft and yielding when moist. From these profounder deeps are dragged by the storm the huge kelps, Tangle or Devil's-apron, the *Laminaria*, looking like some oar with its stem and blade, and often attached to a large pebble of many pounds weight, clinging with its grasping fingers, or bearing in its embrace a huge mussel, on which it had grown. This really noble plant

rising upwards from the bottom of the sea to the altitude of twenty feet or more, typifies those gigantic sea-weeds of the North-western coast, which, in the instance of the *Nereocystis*, has a stem three hundred feet long; or the still larger *Macrocystis* of the Southern Pacific, whose fronds, according to Bory St. Vincent, stretch to a length of fifteen hundred feet! Grander these than any forest tree on mountain or plain, in tropical and luxuriant terrestrial vegetation!

Turning from these, and often lying close by among the heaped waifs from the stormy ocean, the inquirer may see the curious Sea-colander (*Agarum Turneri*), with its tenderer and thinner frond, pierced with numerous roundish holes, and growing, when undisturbed, at the depth of ten fathoms of water; in this single species exhibiting on our coast one of the many kinds peculiar to the Northern Atlantic and Pacific shores. To find its seeds one must select the old and battered specimens cast up in early winter, in the thickened portions of which they form dark-colored patches. Quite distinct, but of the same order, the slender Whiplash or Fishing-line fucus, the *Chorda filum*, lays entangled among the rejectamenta, a simple cylindrical tubular frond, transversely divided into separate cavities, the seeds embedded in the whole exterior surface; and the Honeyware, Murlins or Badderlocks of the shores of Scotland and Ireland, is the *Alaria esculenta*, the midrib of which is eaten by the poorer classes of those countries, but here unnoticed or disregarded, though not uncommon on our coasts.

Some rarer sea-weeds, comprised in the order Dictyotaceæ, may be looked for in the tide-pools, though usually of a more southern habitat, such as the Dot-bearer (*Stilophora*), the seeds being imbedded in little punctiform dots, which internally are made up of bead-like, clavate, branching filaments; the frond cylindrical, imperfectly tubular, branched; while *Dictyosiphon* has a bristly frond, very much branched, the branches capillary, the seeds solitary, a pretty olive-colored "weed;" and, in allusion to these seed-dots, we are

reminded of the *Punctaria tenuissima*, to be sought on the stems of various other fuci and sea-plants, in dense tufts, the fronds very thin and attenuated towards the tips and base. Still, among the olive-colored Algæ, the order CHORDARIACEÆ embraces many distinct sea-weeds with gelatinous or cartilaginous fronds, whose seeds are concealed within the substance of the frond, of which the *Chordaria* and *Mesogloia*, with conspicuous cylindrical fronds, and *Elachista*, or the Least Alga, consisting of little tufts of minute brown fronds parasitical on the common rock-weeds, or fuci, and the Myriad-thread, or *Myrionema*, which hastens the death of the Red Algæ, are worth the looking for microscopical study.

In the tide-pools grow also the sea-weeds which compose the order ECTOCARPACEÆ; and on our shores are *Ectocarpus brachiatus*, and perhaps *littoralis*, pretty confervoid, branching flaccid algæ with numerous pod-like bodies, readily seen with a lens; the *Sphacelaria cirrhosa*, a small species in little globose tufts, the thread-like branches slightly branched again in a pinnate manner, the seeds in round capsules borne on the sides of these smaller and shorter branches, to be examined with the magnifying glass; and, lastly, the *Cladostephus verticillatus*, with fronds six or eight inches high, and furnished with whorls of smaller branches closely besetting the main stems, and giving them the appearance of cylindrical wands of velvet surface, while the seeds are borne on the sides of the smaller branches like those of the last mentioned.

Enough has been said, then, of the green and olive or blackish sea-weeds, a few words of the red or purple ones:

First are the RHODOMELACEÆ, red or brown-red and purple sea-weeds, with leafy, or else with threadlike articulate fronds, the seeds of two kinds, the proper ones borne in capsules on the ends of the branchlets; the others, called *tetraspores*, in tubercules on the sides or other parts of the fronds. These sea-weeds are fond of a more southern ocean and latitude, but in this vicinity *Chondria tenuissima*, the

most delicate of the genus, may be sought; and several *Rhodomelæ*, very beautiful, blackish-red, feathery, and tufted sea-weeds beside, not forgetting the *Polysiphoniæ* of many forms and sizes, the most common, perhaps, and to me the most interesting, being the blackish one, which grows in tufts on fuci, the *P. fastigiata;* others, far more delicate and of more pleasing colors, likewise occur with us; and with them the *Bostrychia rivulsari* also southern in its habits as a genus, and the beautiful *Dasya*, more at home farther south, is often met with in collections of Algæ gathered hereabouts, *D. Elegans* being one of the comparatively sparse Algæ on the sandy shores of Nantucket.

In the order LAWRENCIACEÆ the fronds are terete or compressed, rarely flattened, the seeds contained in external globose conceptacles, the tetraspores immersed in various parts of the frond. There is much diversity in the color of the several species; usually, however, a lurid purple is the typical one, fading on exposure to the light, and parting with it readily on being immersed in fresh water. The *Laurencias*, on which the order is founded, are southern, but *Champia* occurs at Providence, R. I., at Nantucket, and New York, and may be sought as a parasitical plant farther north.

The SPHÆROCOCCOIDEÆ embrace a vast number of very interesting sea-weeds, mostly resident in tropical and foreign seas. I know of none whose structure has interested me more, and if any species occur to the reader on our shores, in the few which may be sought here, they will afford rare gratification with the microscope, their internal structure varying as much as the outward forms. Some of the finest and most brilliant weeds are to be found, a few only are of a duller tint. The seeds are lodged in elegantly formed conceptacles, which are filled with beaded filaments, on the apices of which the seeds are situated; the tetraspores are in definite groups, or else dispersed over the whole fronds.

The DELESSERIÆ have rosy-red, leaf-like, branched, jag-

ged, delicately membranaceous, symmetrical fronds, with a midrib running through the middle of each. They grow in deep water, and several species are found in Massachusetts Bay. By far the most beautiful of them is *D. Americana*, lately dedicated to Henry Grinnell, Esq., conspicuous in his efforts to find Sir John Franklin; and its generic name, derived from his own, was given by Professor Harvey in the Nereis Boreali Americana, some distinctive structure in the seed-vessel being detected by that botanist. The *Grinnellia* being so abundant in New York harbor, may be sought among our Delesserias.

The GELIDIACEÆ, like the last order, is also tropical or mostly foreign. One or two species occur with us, such as *Gelidium corneum*, a most variable plant, with a forked, branched and pinnately divided frond, of a purplish-red, soon changing color, especially if immersed in fresh water, and finally parting with it altogether, but retaining a glossy or waxy lustre when completely bleached.

A rather singular Alga, found in our waters for the first time perhaps, by George B. Emerson, Esq., is the *Polyides rotundus*, a single genus of a single species, and constituting the order SPONGIOCARPEÆ, the seeds of which are found in irregularly shaped warts extending along the branches, of a pale flesh-color, wholly composed of slender, branched filaments, like those of the bark, or cortex, of the frond; the tetraspores are formed in the upper branches deeply immersed.

Passing over several other Algæ too rare on our coast for notice, or else already adverted to, we come to the order RHODYMENIACEÆ, purplish or blood-red sea-weeds, with inarticulate, flat, compressed, or filiform membranaceous fronds, the seeds lodged in external conceptacles. Among these to be sought is *Rhodymenia palmata*, with a frond six to eight inches long, and four to six inches broad, wedge-shaped at base, cut downwards into several slender ribbons, but sometimes quite simple; the *Euthora cristata*, with a

fan-shaped frond, excessively branched, the color a beautiful lake: the *Plocamium coccineum*, very beautiful and frequently overlooked, but occurring among the cast-up weeds of the sea,—a deep-water species.

Other elegant rosy or red sea-weeds, belonging to still other orders, are more or less common in our bay, of which the *Phyllophora membranifolia*, the *Ahnfeltia plicata*, *Cystoclonium purpurascens*, of which there is a curious variety, the ends of the smaller branches being converted in spirally twisted tendrils, which coil round other sea-weeds; the *Gigartina mammillosa*, already alluded to, with the *Chondrus crispus*, of which many singular forms may be seen in the same pools; the *Chylocladia*, reminding us of Bailey, in a new species; the *Gloiosiphonia capillaris*, a single species, limited to the northern seas of Europe and America, of a brilliant carmine color and very much branched, found at Nahant, Hampton Beach, Chelsea, etc., and why not hereabouts? the *Spyridia filamentosa*, a genus better known in warmer seas; the *Ceramiaceæ*, with numerous delicate rosy and reddish species in *Ceramium rubrum* and its varied forms, in *C. diaphanum*, *fastigiatum* and *arachnoideum* perhaps: in *Ptilota plumea*, beautiful and common, and in its kindred Californian species *P. densa*, etc.; in the rarer *P. serrata* occurring with us; in *Griffithsia*, a beautiful and slender Alga, of a soft gelatinous substance, closely adhering to paper; in the numerous *Callithaminons*, minute, elegant, and curious, some of them parasitical, and all puzzling to decide, many of which the seeker can find on our sea-shores.

So much for the sea-weeds, and for the smaller portion of the interest attached to them, reminding us in their fine names of the glories of the ocean, of its cooling breezes, its fitful aspect, its crested foam and blue surface in rest and repose, sought for eagerly by many a weary and tired citizen, and affording perpetual instruction and pleasure to the naturalist, and in its floral as zoölogical treasures a constant source of study to all.

A STROLL BY THE SEA-SIDE.

BY EDWARD S. MORSE.

THE sea-side naturalist has certain advantages not possessed by his inland *confrère*, in the greater variety of life, and in the profusion of material which is daily exposed to him by the tides, and in the debris strewn in windrows along the shores by the heavy storms that sweep along the coast. While he may turn inland and in an hour's walk reach the representatives of animals which are found throughout the continent, the inland naturalist must visit the sea-side to see the living representatives of certain classes that are almost, or quite exclusively, marine.

Even a whole branch of animals, the Radiates, comprising such animals as the sea-anemones, jelly-fishes, star-fishes, and sea-urchins, has only one feeble microscopic representative in fresh water. The class of bivalve mollusca, with its unique sea forms of razor-clam, mussel, scallop, and hundreds of others, is represented in our fresh-water ponds and streams, by the mussels and a few minute forms, though it may be said with truth that the mussels of the Western waters ape in their variety of forms, many of the marine species. The entire class of Cephalopods, comprising the squid, cuttle-fish, and nautilus, is exclusively marine. The extensive class of Crustacea, with the lobster, crab, and shrimp as common examples, are represented in fresh water by the crawfish and a few smaller species. As a slight compensation, however, the inland student has oftentimes stored up in the rocks beneath his feet imperishable mementos of ancient sea-life, and he may there find gigantic ammonites, huge masses of coral, and thousands of other forms remotely similar to existing species in the ocean.

The godsend to an inland collector of a drained canal, or the exposed bottom of a pond after a drought, is daily repeated on the sea-side by the recedence of the tide, leaving

hundreds of miniature aquaria in the crevices of the rocks, freshly stocked and daily replenished by nature, while the surrounding conditions, in the form of clean rocks dried by the sun, the absence of foliage to obstruct the light, offer the collector every opportunity to study the marvels of sea-life in their native haunts. Thus, while the sea-side offers unrivalled attractions to the tourist, it opens to the naturalist a field for study as vast as the sea itself.

Let us take advantage of a day at the sea-side, by a stroll along the shore between high and low-water mark, and jot down a few observations on the more common forms that are sure to meet the eye at every turn. And first of all we notice the rocks whitened as if by a painter's brush. All the exposed ledges, as far as the eye can reach, reflect the rays of the sun like snow-drifts. Can it be possible that this limy covering is made up of little sentient animals, whose soft bodies moisten the rocks, as we crush them by hundreds at every step?

We examine them, and yet no signs of life are seen; closely they remain locked up in their shelly casements. Yet in a neighboring pool of water we see these tiny animals with their doors thrown wide open, and a little crown of feelers flung out in constant action. And this motion is incessantly repeated, making a movement like the grasp of a human hand in space. These animals are known as Barnacles (Plate 6, figs. 1, 2). They not only clothe the rocks in summer, but form an almost impenetrable coat of mail around the piles of our piers, and by their rapid growth foul the ship's bottom at sea.

A closer inspection of this animal with a lens reveals the fact, that the appendages thrown out so actively are lined with little hairs; that the mouth is situated within the shell at the base of these appendages, and that the clutching motion is made to secure the minute particles of food that float in the water, which are swept toward the mouth and secured by it. One hardly wearies of watching the rhythmical and

graceful movements of these never-tiring appendages, and the curious movements of the mouth-parts, as some invisible tit-bit is secured by its perpetual industry.

For a long time these animals were included in the same branch with the clams and snails, until it was discovered, by observing the young stages of the barnacles, that they were more closely allied to the crabs and shrimps, that is, articulated animals, and that they had no relationship with the shell-fish so called. It was found that the young barnacle (Plate 6, fig. 3) was furnished with jointed appendages, having also organs of sight, and that in this condition swam freely in every direction; that finally securing a hold upon some body, it became cemented head downward, lost forever the power of locomotion and the organ of sight, secreted a hard shell around it, and then for the rest of its life, became dependent on the sustenance brought to it by the inflowing tide. We can thus account for the stunted growth of those individuals which have unwittingly effected a lodgement near high-water mark, for in thus securing eligible house-lots, they are left helpless, and imprisoned most of the day, with the scorching rays of the sun to parch their tender bodies, in place of the cool wash of the waves. Fig. 3 *a* represents the young barnacles directly after attachment; fig. 2, another species of barnacle in a state of rest.

In the same pool we notice another strange form, partially concealed by the floating tresses of sea-weed that form so luxuriant a growth of plant-life along the coast. This animal, for it really is an animal, though apparently growing from the rock like a plant, is called the Sea-anemone, or Actinia (Plate 6, fig. 4). A crown of many tentacles, outstretched like the petals of a flower, spring from a leathery cylindrical body, which is affixed by a broad base to the rock. Very little movement is manifested by the animal till we irritate it, when the tentacles slowly unfold till they disappear within the body, leaving only a warty excrescence in place of the beautiful expanded flower (Plate 6, fig. 5).

Waiting patiently a few moments, the tentacles slowly reappear. Noticing the expanded part more attentively, a small slit is seen in the centre of the exposed disk, and surrounded by the tentacles; this is the mouth, and for a proof of it we have only to drop a bit of meat, so that it may fall within the radius of the expanded tentacles, and as it comes in contact with them, is immediately seized, not only by the tentacles against which the meat strikes, but by others that promptly swing in that direction. The tentacles are covered with minute cells, from which threads dart and adhere to their prey. These cells produce a distinct nettling sensation upon the hands of some that are brought in contact with them, and appear to paralyze the living objects upon which they feed. The tentacles appear glued to the meat, and by this power of adhesion rather than that of grasping, the food is passed from one set to the other until it is brought to the mouth, which yawns gradually, and into which it finally sinks. Another bit shares the same fate, even if it is dropped upon the extreme verge of the tentacular crown, and very amusing it is to watch their quaint manœuvres when fed in this way. A small pebble, or other substance not appropriate for food, is instantly rejected. Thus, in this interesting experiment, animality and the power to discover by touch proper substances for food are manifested. The organization of the animal is extremely simple; a cylindrical body having only one proper opening which answers the purposes of mouth and vent; this orifice leading to a sac-like stomach hanging within the body. Also within the body numerous vertical radiating partitions, corresponding to the tentacles that project from the crown, comprises the prominent parts of its structure. An English writer states that "foreigners boil many kinds of Actiniæ for the table, and find them a very pleasant dish. The texture is something like calf's-foot jelly: taste and smell resembling that of crab or lobster. Eaten with sauce, they are savory."

To those who can never conceive a reason for the creation of an animal unless it is either good to eat, offers a remedial agent, or can quickly be converted into money, we add the following receipt for cooking them, from "Devonshire Rambles," by Phillip H. Gosse: "As it was an experiment, I did not choose to commit my pet-morsels to the servants, but took the saucepan in my own hand. As I had no information as to how long they required boiling, I had to find it out for myself. Some I put into cold water (sea-water), and allowed to boil gradually. As soon as the water boiled, I tried one; it was tough and evidently undone. The next I took out after three minutes' boiling; this was better: and one at five minutes was better still, but not so good as the one which had boiled ten. I then put the remaining ones into boiling water, and let them boil ten minutes, and these were the best of all, and more tender as well as more inviting in appearance. I must confess that the first bit I essayed caused a sort of lumpy feeling in my throat, as if a sentinel guarded the way, and said, 'It shan't come here.' This sensation, however, I felt unworthy of a philosopher, for there was nothing really repugnant in the taste. As soon as I had got one that seemed well cooked, I invited Mrs. G. to share the feast; she courageously attacked the morsel, but I am compelled to confess it could not pass the vestibule; the sentinel was one too many for her. My little boy, however, voted that 'tinny was good,' and that 'he liked tinny,' and loudly demanded more, like another Oliver Twist. As for me, I proved the truth of the adage, '*Ce n'est que le premier pas qui coûte*;' for after the first defeat my sentinel was cowed. I left little in the dish." After this he fried them in egg and butter-crumbs, and "all prejudice yielded to their inviting odour and appearance, and the whole table joined the repast with evident gusto."

Space will not allow us to mention at this time the many interesting features regarding its peculiar modes of development, though we may add that the coral insect, so called, is

nothing like an insect whatsoever, but is included in the same class of animals with the sea-anemone, from which it does not depart in any material point of its structure, except that the coral animal deposits lime in its growth, while the sea-anemone does not.

On the moist rocks and wet sea-weed we notice numerous little snails, some of them round, about the size of a pea, dark brown or dingy yellow in color. Dropping some of them into our dish of sea-water, we observe their movements plainly. A little soft-bodied animal, slug-like, with two feelers or tentacles thrust out ahead, having at their base a pair of little black eyes, and between the feelers a roundish trunk like an elephant's proboscis, only very short. This they apply closely to the surface upon which they rest. The mouth opens at the end of this snout. A little tongue within the mouth, furnished with numerous minute hooks, keeps up a continual lapping movement, rasping off the minute vegetation upon which they feed. Looking through the glass jar in which they may be kept, we not only notice the motions of the tongue, but the manner in which they crawl, moving first one side and then the other of the disk-like foot, which seems to be divided by a longitudinal furrow. Notice how gracefully they twirl the shell in their movements. Taking a few in our hand, they quickly withdraw within their shells, and, as they disappear, a lid, called the operculum, which is attached to the tail, closes the aperture effectually. Nearly all of the marine snails, and many of the land and fresh-water snails likewise, are furnished with this operculum.

The eye-stone, so-called, is nothing more than the operculum of some tropical snail; for the opercula of our northern snails are mostly of a horny nature, very few species having calcareous opercula.

The species we have just described is called *Littorina palliata*. Their habits are such that they require a submergence in the sea-water of only a few hours each day. For

this reason one will find them oftentimes in abundance near high-water mark. When kept in an aquarium, they are continually crawling up the sides of the vessel, and out of it completely. Plate 6, figs. 6, 7, represent the shell and animal.

The common Cockle (*Purpura lapillus*), Plate 6, figs. 8, 9, is another very common species on our coast, and a very interesting collection can be made by selecting the different varieties of the shell. Some of the shells are quite solid, and either white in color, or variously banded with brown or yellow; now and then a specimen is found of a rich yellow; others are quite thin and delicate, with the outside covered with little scales, or imbrications. The animal is white, and the operculum is a rich brown or reddish.

This species is carnivorous in its propensities, and with its sharp rasp-like tongue, will drill the neatest round holes in the shells of other species, and through the hole thus made devour the contents. The empty shells of the cockle's victims, or of other carnivorous species, may always be recognized by the little countersunk hole in the shell. The mussel seems to be a favorite food of the cockle. It has been ascertained that it requires two days for the cockle to drill through the shell of the mussel, and, after the animal dies from this rude treatment, the shell gapes open, and the cockle then feeds upon the soft parts within, through the natural opening. The eggs are laid in little oblong yellow-colored capsules, which they deposit in clusters on the rocks (Plate 6, fig. 9*a*). Each little capsule contains from sixteen to thirty young, which eat their way out through the cases when fully developed. The cockle was supposed to be the species from which the celebrated Tyrian purple was obtained. At all events, there is a coloring matter extracted from the living animals, which is at first yellowish, but after exposure to the sun's rays, will gradually change, passing through various shades of green and violet, then to a purple, and finally to a crimson. It is often used for bait in fishing

for cunners, or perch, and the fingers become stained a deep purple after handling the crushed animals.

In the crevices of the rocks, and in certain pools left by the tide, we shall find the common salt-water mussel (Plate 6, fig. 10) closely compacted in great numbers. On attempting to detach a specimen from the rocks, it is found that they are held in place by a strand of little silken threads, issuing between the valves of the shell, and adhering strongly to the rock. This bunch of threads is called the byssus, and a tropical genus, called Pinna, produces a byssus of considerable size. Gloves have been woven from the fibres composing it. The individuals covered by water display at the free end of the shell and between the valves (each shell of a bivalve is termed a valve, hence the name *bivalve*, two valves), which are partly open, two openings formed by the mantle. These openings are scarcely divided; one opening reaching nearly to the byssus is beautifully fringed with little arborescent fringes, the other opening is plain. If we watch the particles floating near these openings, it will be seen that a current of water is passing in at the fringed opening, while from the simple opening a current of water is as constantly issuing. These currents of water are produced by the vibration of little moving hairs, or cilia, which line the membranes within. The gills, of which the animal has four, two on each side, are particularly covered by the cilia, so that if the shell is broken open, and a piece of the gill is separated from the animal, it will swim round in the water like an independent animal for some time. We become acquainted with an excellent provision in this arrangement, for in the first place the currents of water kept up in this way bring a continual supply of fresh sea-water to the gills, and in the second place the food of the mussel, which is mostly of an infusorial character, is brought to the mouth by the same means. The two short openings we have seen in the mussel, in other genera like the clam are prolonged into two long tubes covered by one sheath, or form two distinct tubes as in certain other genera.

In contemplating the many complete provisions made for these lower animals in procuring their food, one is led to admire the adaptability of ciliary motion which appears to take so prominent a part in the functions of the lower animals. Among the lowest forms of life, locomotion is effected entirely by ciliary motion; among others, food is brought within the compass of their mouth, and the gills are continually bathed with fresh water. Generative products are brought together for the impregnation of the eggs. The new-born animal is borne safely to some place of attachment, or to a proper position for future growth.

A large and ponderous mussel, called the Horse-mussel, may be torn out from the crevices of the rock just at low-water mark, and the roots of the large sea-weed, commonly called the "devil's apron," are often found entwined around specimens of this species. While speaking of this gigantic sea-weed, we may say that after storms, and in fact at nearly all times, this Laminaria, as it is technically termed, may be found on the shores, and the collector must never fail to examine carefully every portion of it for novelties. On the broad crenulated brown frond he will find certain species of snails browsing. On the stem, patches of calcarious growth, looking like the most delicate lace, may be seen; strange as it may appear, each little cell, composing this lace-work, is occupied by a tiny animal, whose true relations are with the clams and oysters. In the tangled roots the collector often reaps a rich harvest of marine worms, brittle starfishes, minute crustaceans, and many other animals. The reason why this sea-plant affords such an interesting field for the collector is, that it comes from beyond low-water mark. In the sea, as on the land, there are different zones of animal and plant-life. Thus on the land we find in low places certain species of plants and trees; a little higher we have the hard-wood growths; on the mountain slopes the pines and spruces flourish, while near the tops of our highest mountains lichens only can exist, and at the highest elevations the bare rocks alone meet the eye.

So in the sea, between high and low-water mark is an assemblage of animals and plants peculiar to that area, and this is called the littoral zone; from low-water mark to about fifteen fathoms another group of plants and animals are found, and as the Laminaria grows to profusion in this zone, it is called the laminarian zone. Below this we have the coralline zone, and deep sea-coral zone. Many animals range through all these zones, but there is a sufficient number of species restricted to each, which give each zone a determinate character. Thus the Laminaria is an envoy from another zone, coming laden with the animals and plants peculiar to its zone. As we are confining ourselves to those forms that are abundant between high and low-water mark, we must reluctantly leave for another time the treasures that this sea-weed possesses.

The common starfish, or five-finger jack (Plate 6, fig. 11), is one of the abundant forms under rocks at low-water mark. By throwing back the masses of sea-weed that conceal the rocks near the water's edge, they may be found of all sizes, and of every shade of brick-red, crimson, and purple. How fast they cling as we attempt to pluck them from the rocks, and by examining the underside of the fingers, or arms, we notice rows of suckers, that look like so many worms twisting and writhing in every direction! Dropping one into a dish of sea-water, we soon see the admirable use that is made of these suckers, for now they act like so many little legs. These suckers are enabled to project some little distance from the animal, and by these the animal is carried from one place to another. How gently they glide over the uneven surface of the rock, each sucker in turn reaching in advance and securing a hold, and, after contracting and thus pulling the body along, relaxing for a new start! Perhaps by diligent search you may capture a starfish at his dinner, and a strange way he has of eating it. Mussels, beach-cockles, and shell-fish, form the favorite food of the starfish.

Having selected one for his meal, our starfish arches his body over the shell, grasping it at the same time with its arms, and then, marvellous to relate, puts its stomach out of its mouth and enfolds the shell with its lobes. Whether the stomach secretes a poisonous fluid is not known, at any rate the victim dies under the effects of this warm embrace, the shell flies open, and the starfish devours its contents.

In the young starfish the eyes can be plainly seen, five in number, one at the end of each ray or arm, shining like little garnets. In the older ones it is quite difficult to distinguish them.

The starfish often loses one or more of its rays from having them bitten off by hungry fishes, or perhaps crushed off by crabs when young. Nature, however, restores them again, for new rays bud in the place of those lost, and it is not uncommon to find specimens that have lost all but one ray, with the four new rays just commencing to grow. Others may be found with three large ones, and two small ones, and a variety of forms, resulting from this renovating power after mutilation, may be gathered among the rocks.

Another curious starfish, called the brittle starfish (Plate 6, fig. 12), is found in the pools at extreme low-water mark. It takes its name from the fact that it is extremely brittle, the arms falling to pieces when roughly handled. In this species the arms appear quite independent of the disk, not merging into it as the species previously described. The arms, moreover, have greater freedom of motion. Though they have no true suckers, the arms are covered with spines, and, having great mobility, they twist and turn in every direction, and are quite active when compared to the common "five finger."

We have referred to their brittle nature, but another species, belonging to the same family, occurring on the English coast, has for its specific name "fragilissima," on account of its extreme fragility. Edward Forbes has given an amusing account of his endeavors to capture this species, and we pre-

sent it here: "The first time I ever caught one of these creatures, I succeeded in getting it into the boat entire. Never having seen one before, and quite unconscious of its suicidal powers, I spread it out on a rowing-bench, the better to admire its form and colors. On attempting to remove it for preservation, to my horror and disappointment I found only an assemblage of rejected members. My conservative endeavors were all neutralized by its destructive exertions, and it is now badly represented in my cabinet by an armless disk and diskless arm. Next time I went to dredge on the same spot, and, determined not to be cheated out of a specimen in such a way a second time, I brought with me a bucket of cold fresh-water, to which article starfishes have a great antipathy. As I expected, a *Luidia* came up in the dredge, a most gorgeous specimen. As it does not generally break up before it is raised above the surface of the sea, cautiously and anxiously I sank my bucket to a level with the dredge's mouth, and proceeded in the most gentle manner to introduce *Luidia* to the purer element. Whether the cold air was too much for him, or the sight of the bucket too terrific, I know not, but, in a moment, he proceeded to dissolve his corporation, and at every mesh of the dredge his fragments were seen escaping. In despair I grasped at the largest, and brought up the extremity of an arm with its terminating eye, the spinous eyelid of which opened and closed with something exceedingly like a wink of derision."

While parting carefully the floating masses of sea-weed in search for other novelties, our attention is attracted by the unusual movements of a large shell, commonly called the whelk. As the customary movements of nearly all mollusks are slow and sluggish, we are the more surprised at these movements. We at once secure the shell, and are rather confounded to find it a bleached and sea-worn specimen, with no traces of its original inhabitant within. We drop it upon the rocks, and directly out comes a singular-looking

crab, not quite out, for he retains a hold upon the shell and drags it alertly after him. We have found the Hermit-crab (Plate 6, fig. 13), called by some the Soldier-crab on account of its extreme pugnacity, and receiving the first name, because, like a hermit, it lives alone in its shelly house.

The species belonging to this genus are remarkable for the singular softness of the hinder portion of the body; this is rather long, and is coiled on itself. To protect this soft part, that would otherwise be nipped off by some hungry fish, the crab resorts to some empty shell, and, inserting his tail into the aperture, makes it his home, and carries it about with him in all his perigrinations.

The hermit-crab, like other members of the class Crustacea, increase in size through a process called "moulting." The hardened crust outside does not grow. It is only a hardened skin, as it were. Now as the body within increases in size, the outside shell must be thrown off, to allow the enlargement of the animal. This throwing off of the outside crust is called *moulting*, and takes place at certain times. With the crabs, lobsters, and others, the animal appears to fast for some time, retires to a secluded nook in the rocks, and there awaits the cracking open of its well-worn coat. This crack takes place along the back, and through this opening the animal draws itself. After it comes forth its skin is soft and tender, and some time is required before it is sufficiently hardened to enable it again to successfully battle with its enemies.

Our hermit-crab has still another stage to go through after moulting, for when this process has taken place, it finds its coiled shell too small for it, and must go on that tiresome search, called house-hunting. Back and forth it travels on the beach, surveying with critical acumen the tenantless shells on the beach. Here it meets one altogether too large, and an amusing sight it is to see it drag its soft and helpless tail from the shell, to try another one on to see if it fits. Sometimes it meets with a shell that is apparently just the thing.

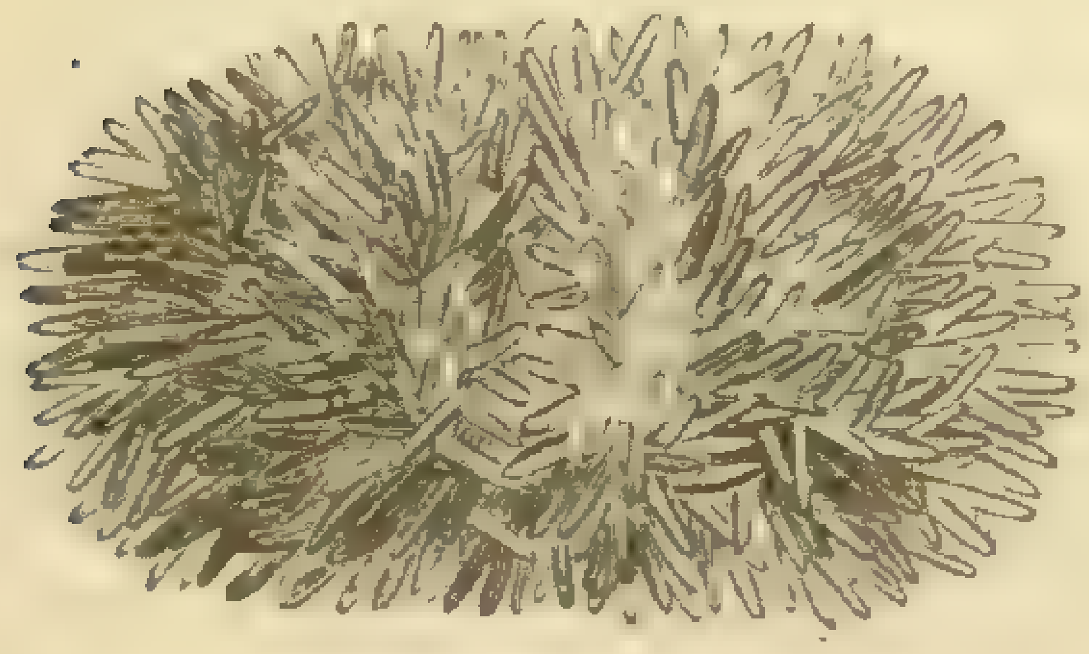
but unluckily it is already occupied by a brother hermit. A freebooter is our hermit, and so without any apologies it proceeds by force to eject the tenant. A fight ensues, and oftentimes ends in the ejectment and mutilation of one or the other. Perhaps the name Soldier-crab is more appropriate, from its belligerent character. Gosse has described one of these fights, from which we subjoin the following: "The Soldiers (as indeed becomes their profession) are well known to be pugnacious and impudent, yet watchful and cautious. Indeed, their manners and disposition, no less than their appearance, bear the strongest resemblance to those of spiders. Two of them can scarcely approach each other without manifestations of hostility; each warily stretches out his long feet and feels the other, just as spiders do, and strives to find an opportunity of seizing his opponent in some tender part with his own strong claws. Generally they are satisfied with the proofs afforded of mutual prowess, and each, finding the other armed at all points, retires; but not unseldom a regular passage of arms ensues; the claws are rapidly thrown about, widely gaping and threatening, and the combatants roll over and over in the tussle. Sometimes, however, the aggressive spirit is more decided and ferocious. One in the aquarium of the Zoölogical Gardens was seen to approach another, who tenanted a shell somewhat larger than his own, and, suddenly seizing his victim's front with his powerful claw, drag him like lightning from his house, into which the aggressor as swiftly inserts his own body, leaving the miserable sufferer struggling in the agonies of death."

The reader must bear in mind that we have only touched upon the more common forms to be met with on the coast, and that without the least difficulty he may find a legion of others, equally as interesting, and readily preserved alive in sea-water for a considerable time. He will do well to carry away with him a pailful of these animals, with a generous supply of sea-water in which to immerse them. The numerous sea-worms, of which we have not spoken, will repay

him a careful hunt. A common worm on the coast he will find in the guise of a coiled white shell, firmly cemented to a bit of sea-weed or other substance. Sometimes a frond of sea-weed will be whitened with them. They are quite small, and to examine them properly will require the assistance of a lens. The head is surrounded by numerous little appendages, which answer the purpose of gills. One of the appendages is thickened and rounded at the end, and serves as a plug to the aperture of the shell, when the animal retires.

Fig. 14, plate 6, represents an enlarged figure of this worm, with the animal protruding, and the adjoining figure shows a bit of sea-weed, with several of the worms drawn to the natural size.

The adjoining cut represents the appearance of an animal quite abundant at low tide, commonly called the *Sea-urchin*. It is covered with a great many long sharp spines, and in addition to these spines, there are five zones of suckers passing from the mouth, which is below, to the opposite pole of the body. These



suckers perform locomotive functions, as do the suckers of the starfish described above, and the collector will be repaid in watching the movements of the animal alive. The sea-urchin, when dead and bleached upon the beach, forms a very curious object. A flattened spherical shell, composed of a large number of small plates, all neatly fitted together; five zones of these plates perforated for the passage of the suckers, and all the plates ornamented with minute rounded protuberances upon which the spines were attached, make up the empty shell of the sea-urchin. We may briefly add, that the collector will find in the piles of dried sea-weed rolled up by the waves, many curious objects all prepared and dried by the sea and the sun. If on the long beaches, he will find many interesting shells, dried

MORSE ON THE COMMON ANIMALS OF THE SEA-SHORE.

crabs, empty shells of sea-urchins, and oftentimes many objects that are really worth preserving for cabinet specimens.

EXPLANATION OF PLATE 6.

Fig. 1. Common Barnacles, *Balanus eburneus* of Gould.
Fig. 2. " " " *ovularis* "
Fig. 3. Free swimming young of Barnacle.
Fig. 3*a*. Young Barnacle directly after attachment.
Fig. 4. Sea-anemone expanded, *Metridium marginatum*.
Fig. 5. " contracted,
Figs. 6, 7. Periwinkle, *Littorina palliata*.
Figs. 8, 9. Cockle, *Purpura lapillus*.
Fig. 9*a*. Egg-cases of the same.
Fig. 10. Mussel, *Mytilus edulis*.
Fig. 11. Starfish, *Asterias vulgaris*.
Fig. 12. Brittle Starfish, *Ophiopholis bellis*.
Fig. 13. Hermit-crab, *Bernhardus longicarpus*.
Fig. 14. *Spirorbis nautiloides*.

OUR SEA-ANEMONES.

BY A. E. VERRILL.

To all frequenters of the sea-shore during the summer months who take pleasure in seeking and studying the many wonderful and beautiful inhabitants of the ocean, the modest and retiring Sea-anemones cannot fail to offer many attractions; and there are few marine creatures that can so easily be reconciled to the narrow limits of an aquarium, and so readily become permanently established in their new home. Thus they afford us every opportunity to study their habits and structure, and to watch their ever-varying forms and beautiful colors. But to see them in their perfection one must visit them in their native haunts in some cool, rocky pool, overhung with projecting ledges and drooping seaweeds, or in some deep grotto among the shattered cliffs, half-illumined by the sunbeams which struggle for entrance

through the cool sea-weeds that hang from the rocky roof dripping with salt dew. In such favorite retreats the *Fringed Sea-anemones** (Plate 6, figs. 4, 5) make their home and rear their numerous families, year after year, until every nook and crevice is fully occupied, and even the entire floor is completely carpeted by their soft, delicate tufts of tentacles. In such localities it is common to see specimens of every variety of hue, from pure white, pink, salmon, chestnut, orange, yellow, and light-brown, to dark-umber; while others will be mottled or variously striped with two or more colors. These colors, however, are those of the outer wall of the body. But the upper part of the body and the innumerable tentacles have lighter and more delicate tints, and this, combined with their translucent texture, gives to the summit of the body and its broad crown of fine tentacles a peculiarly graceful appearance, which is much increased by the numerous deep frills into which the tentacle-crowned margin of the disk is always thrown in the large specimens. The tentacles are also frequently banded with white. It is always difficult to decide which specimen in one of these numerous colonies is most beautiful when all are so attractive. But the pure white ones most frequently suffer for their beauty, and are borne away in triumph to new homes, which, perchance, prove in the end less happy and pleasant to them than the home of their youth.

The Fringed Sea-anemone is not found exclusively in such places as described, but may be found on almost any rocky or ledgy shore along the coast of New England, and in fact from New York to Labrador, snugly ensconced in the crevices between boulders, or on their under surfaces, wherever there is sufficient space to expand their tentacles, and complete shade from the sun's heat. For although these lowly

* *Metridium marginatum* Edw. and H. For a more complete description, see "A Revision of the Polyps of the Eastern Coast of the United States," by A. E. Verrill, in Memoirs of the Boston Society of Natural History, Vol. I. For other descriptions and figures, see "Sea-side Studies in Natural History," by E. C. and A. Agassiz, and Tenney's Zoölogy.

organized creatures have no eyes, nor even nerves, they are very sensitive to strong light, and love the shade. They may also, at times, be found clinging to the piles of wharves, and on small stones and shells, wholly unprotected. Near Mount Desert Island, I once saw, during a very low tide, a large surface of rocky bottom so completely covered by them, that the foot could not be put down without crushing many noble specimens. A single stone, the size of a man's head, taken from this place, was found to be the residence of sixty individuals, of all sizes. They sometimes occur at a greater depth than twenty-five fathoms, but are frequently found between high and low-water mark, both in pools and in places where they are left dry for an hour or more, where they hang relaxed and flabby until the tide returns, when they quickly revive. To remove large specimens of this species from their favorite rock, without serious injury, is no easy matter; for although they are not permanently attached, but are capable of moving freely about by gliding along upon their large, highly muscular, adhesive base, yet when disturbed they cling so closely and firmly to the rock, that they are very liable to be torn open upon the base, rather than loosen their hold. But if the rock be tolerably smooth, by gradually and carefully starting them up by pushing with the thumb-nail or some dull instrument against and under the base, they may finally be safely removed. If broken open they will never recover or heal, though they will usually expand and appear very well for several days.

In the confinement of an aquarium, or even in a jar or bowl of sea-water, one of these Actinias will soon make itself at home, and, fixing itself upon one side of the vessel by its base, will expand its feathery plume of tentacles day after day in search of tiny prey, and woe to the unlucky creature, be it animalcule, shell-fish, shrimp, or fish, that comes in contact with its crown of gorgon-tentacles, armed with myriads of poison-darts, deadly to all creatures destined to be its prey! When fully expanded, this species has

a very graceful form, which cannot fail to please any one who has a taste for the symmetry and beauty of natural objects. From the slightly expanded base the body arises in the form of a tall, smooth column, sometimes cylindrical, sometimes tapering slightly to the middle, and then enlarging to the summit. Towards the top the column is surrounded by a circular, thickened fold, above which the character of the surface suddenly changes, the skin becoming thinner and translucent, so that the internal radiating partitions are visible through it. This part expands upward toward the margin, which is folded into several deep undulations or frills, and these edges are covered everywhere by an immense number of fine, slender, crowded tentacles, which also occupy about half the width of the oral disk, but increase in size and diminish in number toward the mouth, which occupies the centre of the disk. The mouth is oval, and its lips have numerous folds. It opens directly into the stomach, which is a simple sac suspended in the centre of the body, having a small opening in its lower end, through which the products of digestion are poured into the main cavity of the body, while the hard or undigested parts of the food, such as shells, bones, etc., are cast out from the mouth. The whole interior of the body, between the stomach and exterior, is divided up into an immense number of narrow chambers, by thin muscular partitions, which radiate from the centre toward the exterior, and are of various widths, some reaching from the wall to the stomach and serving to support it, while others extend only a little way inward from the outer wall; each tentacle is hollow and is a direct continuation of the radiating chamber below it, so that there are as many chambers as tentacles, and, of course, twice as many radiating partitions as chambers. The digested food, mingled with sea-water, serves for blood, and fills all the chambers and the main cavity of the body below the stomach; and, as there is no heart, this fluid is put in motion and circulated through every part by means of

myriads of minute vibrating lashes, or *cilia*, that cover all parts of the interior surface, and this same surface of soft membrane has the power of absorbing such nutritious substances as each organ may require, from the fluid that bathes it, and also the oxygen contained in the sea-water. Indeed it is probable that every part of the surface, both external and internal, has the power of absorbing oxygen; but it is reasonable to conclude, that this takes place most rapidly in the tentacles and internal membranes where the structure is most delicate.

We usually notice, when trying to remove one of these Actinias from its rock, a large number of white, thread-like organs, emerging both from the mouth and from minute openings through the sides of the body. These organs appear to be for the defence of the creature, since they are found to be composed almost entirely of minute poison-darts, or lasso-cells, arranged side by side, and having a deadly stinging power when used against small animals. In fact there are very few of the predacious marine animals, even not excepting the voracious fishes, that have the temerity to attack one of the harmless-looking Sea-anemones; for though their darts may not have sufficient power to kill a large fish, they will, at least, penetrate the thin membranes of the mouth and produce a severe stinging, like that of nettles. And since these stinging threads may be thrown out copiously, and are several inches long, they are very effectual organs of defence. The inner ends of the threads are attached to the free edges of the radiating partitions, and the free ends are thrown out simply by the contractions of the animal, and consequent expulsion of the fluid contained in its body, which, as it rushes out of the mouth and through the loop-holes of the sides, carries with it the threads. When the Actinia is again left in repose, it gradually draws in its stinging threads. The little poison-darts, usually called lasso-cells, which cover both these threads and the tentacles, have a wonderful structure for organs so minute. They

consist of little vesicles or cells filled with fluid, and have a very long, extremely thin tube, coiled up in the interior. This tube is continuous with one end of the vesicle that contains it, so that when the vesicle is compressed or contracted the fluid forces out the tubular dart by turning it inside out, as one would turn the finger of a glove. The slender tube, when thrust out, is very long, slender, and pointed, and usually curiously and wonderfully barbed. The nature of the poison, so deadly to small animals, which these darts emit when they penetrate the flesh, is still unknown: but whatever its nature, it must be very powerful, for the quantity is necessarily excessively small. The tentacles not only capture and kill the prey by means of these organs, but by means of the darts, that thus penetrate in large numbers, they hold it firmly until conveyed from the tentacles to the mouth. Among our native Sea-anemones there are no species that have darts powerful enough to sting the hand, though some species, like the Star-anemone, will often adhere so firmly, if its tentacles be touched by the finger, that it may be lifted from the water before it will loosen its hold. This adherence is doubtless due to the many lasso-cells that partially penetrate the epidermis, or outer layer of the skin, but have not power to enter far enough to reach the sensitive portion. But the common, large, red Jelly-fish (*Cyanea arctica*) has similar poison-darts covering its long, floating, thread-like tentacles, which are powerful enough to penetrate the human skin, and sting far more painfully than nettles. And among the coral reefs of Florida and the West Indies there are corals (*Millepora*) which, unlike most corals, have animals belonging to the same class with the Jelly-fishes, and their tentacles have poison-darts, which, according to the observations of Professor Hartt, sting the parts of the hands where the skin is most delicate very severely. The same is true of some other *Hydroids*, which do not form coral, but grow in moss-like tufts. It is also said that some of the foreign Sea-anemones have the same power of stinging

the hands, and especially those of persons having a delicate skin. But certainly no such charge has ever been brought against any of our native species.

The Fringed-anemone makes a very pleasing pet in confinement, and, if allowed plenty of room and fresh sea-water, will expand almost constantly. It feeds readily upon the flesh of all sorts of shell-fish, etc., and will not refuse bits of raw beef. And if necessity compels, it will live for months, or even a year, without food; but, curiously enough, it will continually grow smaller and smaller, so that a specimen, at first five or six inches high and two in diameter, may thus be reduced to the height of an inch, and the diameter of less than half an inch, the number of tentacles and chambers being proportionately reduced. In fact, under such circumstances, the animal seems to undergo a retrograde process, exactly the reverse of that by which it originally developed from youth to maturity.

The ovaries of Actinias, and all similar animals, including the coral-polyps, are attached to the inner edges of the radiating partitions below the stomach, and are filled with immense numbers of eggs, which are discharged, when mature, directly into the fluid filling the body, and then are either discharged very soon from the mouth, or are retained for a longer or shorter time, until they are hatched into miniature Actinias, which are discharged in different stages of development and of various sizes; but however small they may be, they are perfectly competent to take care of themselves from the first. The Fringed-anemone, and some other kinds, when they remove from places where they have long been stationary, are liable to tear off and leave behind them little fragments from the edge of the base, but every one of these fragments will in a few days develop a little mouth and a row of tentacles around it, and will soon become a perfect little Actinia, differing only in size from its parent. The same effect may be obtained at will by cutting off little portions from the edge of the base with a sharp knife. This

process is evidently analogous to the wonderful powers of restoration and development of mutilated and lost parts, so well known by experiments upon the fresh-water *Hydra* and other low animals, some of which may be cut up in every direction into many pieces, and each part will still restore all the parts that are lacking. It has, also, some analogy to the process of budding, so common among the coral-polyps.

The *Star Sea-anemone** is another beautiful and interesting species, which may readily be domesticated in an aquarium, and proves very hardy in confinement. This species, instead of having a smooth body like the preceding, is covered with little wart-like pustules, arranged in vertical rows, which have the power of adhering firmly to foreign substances, such as bits of shell and sea-weed, with which it often so completely covers its body as to effectually conceal itself, when contracted into a low cone among the rocks and gravel where it often dwells. But when it lives, as it frequently does near Eastport and about the rocky shores of the neighboring islands in the Bay of Fundy, in fissures and cavities of ledges, overhung and protected by sea-weed, it usually discards its foreign covering, which now becoming no longer useful, is evidently regarded as a burden. When placed in an aquarium, even if covered with foreign matters, it very soon discards them and appears perfectly clean. The uppermost pustule of each row is larger than the others, and forms an inflated vesicle just below each tentacle. The tentacles, instead of being very small and numerous, as in the Fringed-anemone, are comparatively few, rarely more than seventy-two in the largest specimens, but they are large and often more than an inch long. The mouth usually has the form of a cross, with several prominent folds upon its lips. Its body is usually pale, translucent, olive-green, sometimes approaching flesh-color, and the disk and tentacles have a lighter tint of the same colors, while the tentacles are con-

* *Bunodes stella* Verrill. Memoirs of the Boston Society of Natural History, Vol. I, p. 16, Plate I, figs. 1 to 8. Also a figure copied in Tenney's Zoölogy.

spicuously banded with opaque-white, and upon the disk there are usually six or twelve white lines, radiating from the mouth to the bases of the tentacles. Most of the tentacles usually have a white, heart-shaped spot upon the inner side of their bases. This pretty Actinia is very common at Eastport and vicinity, and has been found at Cape Elizabeth, Maine. In the latter locality the specimens were half-buried in sand at the bottom of a rocky pool near low-water mark. Doubtless it will be found upon all parts of the rocky coast of Maine. In confinement it expands most freely in the evening. It feeds, like the other species, upon all sorts of mollusca and crustacea that come within its reach. It brings forth living young, often of considerable size, which emerge at irregular intervals from the mouth, sometimes singly, sometimes in large numbers. It does not grow so large as the preceding, the body seldom becoming more than two inches high and one in diameter, but having more than twice that diameter across the expanded tentacles.

The *Red Sea-anemone** is unquestionably the most beautifully colored and showy of all our northern Actinias; but, although very changeable in shape, it lacks the elegant forms assumed by other species. The body usually forms, in expansion, a low cylinder, broader than high, with a broad disk, surrounded by a moderate number of large, rather short, tapering or blunt tentacles. The exterior of the body is sometimes nearly smooth, but at other times shows a few, rather inconspicuous, warts or suckers scattered over the surface. The colors are extremely variable. The shore specimens are mostly irregularly mottled with deep brownish red, and dull greenish, while the tentacles are pinkish, banded with opaque-white. The disk is often light-greenish or pink, with radiating lines of purple or

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* *Rhodactinia Davisii* Agassiz. For full descriptions see the Memoirs Boston Society above quoted, and for a figure, "Sea-side Studies," p. 13, fig. 10. This species belongs to the "sub-genus" *Urticina* of Ehrenberg, and as that is an earlier name, it should be called *Urticina Davisii*, until it be settled whether it be really distinct from *U. crassicornis* of Europe.

deep red, which embrace the bases of the tentacles. Occasionally shore specimens are found having the body uniformly bright red, crimson, or pink, with a lighter-colored disk and tentacles. The tentacles are usually banded with white in all varieties, but are sometimes uniform pink and translucent. Other specimens often have the body pink, mottled with orange-red, or blotched with crimson. The specimens from deep water have generally brighter and clearer colors than those of the shore, but are quite as commonly found mottled with two or more shades of red, as of uniform red or pink colors. The habits of this fine Actinia are much like those of the last, and the young are produced in the same manner. It attains a much greater size, for specimens are not uncommon which are two inches high and four or five in diameter when expanded. The large specimens, however, are apt to be troublesome inmates of an aquarium, on account of their remarkable voracity, for nothing seems to come amiss to them. They will capture and swallow fishes of considerable size, as well as crabs, mollusks, etc., and even have been known to swallow the spiny sea-urchins of considerable size. Other Actinias, even, are not safe in their neighborhood. Such large specimens also have a singular habit of frequently protruding the stomach, and even turning it wrong side out, as if affected with nausea, which certainly adds nothing to their beauty. But specimens of small or medium sizes make very interesting pets, and are often more beautifully colored than the large ones.

In Massachusetts Bay this species is seldom found except by dredging, when it usually comes up adhering to stones and dead shells. It inhabits all depths down to forty fathoms at least. At Eastport, Grand Menan, and other islands at the mouth of the Bay of Fundy, where the enormous tides leave exposed, at low-water, a wide zone, unusual facilities are afforded for obtaining all sorts of rare and curious marine productions, which, on other parts of the coast, can be

obtained only by dredging in deep water. On these shores the two large *Solasters*, or Starfishes, with ten or twelve rays and beautiful colors, together with several other rare Starfishes, the Daisy Serpent Star,* the many-armed Basket Fish,† several large and curious Holothurians, the elegant Alcyonium, the much-sought Terebratula, many curious and beautiful Ascidians, among which the Cynthia,‡ or "Sea Peach," is one of the finest, and a great variety of rare shells, may all be obtained at low-water, during the extreme tides, together with a great abundance of the three Actinias above described. The Red, like the Star Sea-anemone, loves best the fissures and crevices of the rocks and ledges, that are thickly overgrown with fuci and other sea-weeds, which furnish a complete protection to the animals nestling among the rocks. Even among the lofty wharves of Eastport there are ledges in the crevices of which hundreds of these Anemones may be found.

The *White-armed Sea-anemone*,§ unlike the three preceding species, is as yet unknown except along the southern coasts of New England, upon the shores of Long Island Sound, and near New York City. This Actinia is more nearly related to the Fringed-anemone than to the others, and like that has slender tentacles, and loop-holes along the sides of the body, out of which threads of stinging darts issue, which are lacking in the two last species. But this is a smaller and more delicate kind, seldom growing more than three inches high and one in diameter, and the tentacles are much longer and not so numerous. The body is of the same texture from base to summit, and the edge of the disk is not thrown into undulations, or "frilled." Its colors are usually light-yellowish, or flesh-colored, and translucent, while the tentacles are usually white. It lives most commonly at-

* *Ophiopholis bellis* Lyman. Plate 6, fig. 12.
† *Astrophyton Agassizii* Stimpson.
‡ *Cynthia pyriformis* Rathke.
§ *Sagartia leucolena* Verrill. Proceedings of Boston Society of Natural History, Vol. X. p. 336. 1866.

tached to the under side of boulders that have a cavity beneath them, and is well adapted to the aquarium, where it very soon becomes perfectly at home, and expands almost constantly. Inhabiting the same region with this there is another more rare species of *Sagartia*,* which is duller in color and less graceful in form, which lives buried up to its tentacles in gravel.

Besides the species already described, there are several others that are less conspicuous, which inhabit the New England coast, several of which live buried in sand or mud, like many worms, and only protrude their tentacles at the surface. These kinds are usually long and slender, and taper at the base instead of having a flat adhesive disk. Farther southward on the Carolina coast there are several other peculiar species, some of them beautifully colored, and also several species of true corals, the animals of which closely resemble the Sea-anemones in structure and habits. One pretty species of coral † is even found on the southern coast of New England. This is found just below low-water mark, encrusting stones and shells, and forming little irregular masses of coral, covered with star-like cells or cups, which are about an eighth of an inch across. The polyps, which in life rise above these stellate cups, are colorless and almost transparent, resembling, in nearly all respects, miniature Actinias. This coral lives well in confinement, and feeds readily upon bits of oyster, in the same manner as the Sea-anemones.

THE MARINE AQUARIUM.

Buy at any glass-shop a cylindrical glass jar, some six inches in diameter and ten high, which will cost you from three to four shillings; wash it clean, and fill it with clean

* *Sagartia modesta* Verrill. Described with the preceding species.

† *Astrangia Danæ* Agassiz.

salt-water, dipped out of any pool among the rocks, only looking first to see that there is no dead fish or other evil matter in the said pool, and that no stream from the land runs into it. If you choose to take the trouble to dip up the water over a boat's side, so much the better.

So much for your vase; now to stock it. Go down at low spring-tide to the nearest ledge of rocks, and with a hammer and chisel chip off a few pieces of stone covered with growing sea-weed. Avoid the common and coarser kinds (fuci) which cover the surface of rocks; for they give out under water a slime which will foul your tank; but choose the more delicate species which fringe the edges of every pool at low-water mark; the pink coralline, the dark purple ragged dulse (*Rhodymenia*), the Carrageen moss (*Chondrus*), and, above all, the commonest of all, the delicate green Ulva, which you will see growing everywhere in wrinkled fan-shaped sheets, as thin as the finest silver paper. The smallest bits of stone are sufficient, provided the sea-weeds have hold of them; for they have no real roots, but adhere by a small disk, deriving no nourishment from the rock, but only from the water. Take care, meanwhile, that there be as little as possible on the stone beside the weed itself. Especially scrape off any small sponges, and see that no worms have made their twining tubes of sand among the weed-stems; if they have, drag them out, for they will surely die, and as surely spoil all by sulphuretted hydrogen, blackness, and evil smells.

Put your weeds into your tank, and settle them at the bottom, which last some say should be covered with a layer of pebbles; but let the beginner leave it as bare as possible, for the pebbles only tempt cross-grained annelids to crawl under them, die, and spoil all by decaying; whereas if the bottom of the vase is bare, you can see a sickly or dead inhabitant at once, and take him out (which you must do) instantly. Let your weeds stand quietly in the vase a day or two before you put in any live animals; and even then, do

not put any in if the water does not appear perfectly clear: but lift out the weeds, and renew the water ere you replace them.

Now for the live-stock. In the crannies of every rock you will find sea-anemones (*Actiniæ*); and a dozen of these only will be enough to convert your little vase into the most brilliant of living flower-gardens. There they hang upon the underside of the ledges, apparently mere rounded lumps of jelly; one is of a dark purple, dotted with green; another of a rich chocolate; another of a delicate olive; another sienna-yellow; another all but white. Take them from their rock; you can do it easily by slipping under them your finger-nail, or the edge of a pewter spoon. Take care to tear the sucking base as little as possible (though a small rent they will darn for themselves in a few days, easily enough), and drop them into a basket of wet sea-weed; when you get home, turn them out into a dish full of water and leave them for the night, and go to look at them to-morrow. What a change! The dull lumps of jelly have taken root and flowered during the night, and your dish is filled from side to side with a bouquet of chrysanthemums.

Let your Actiniæ stand for a day or two in the dish, and then picking out the liveliest and handsomest, detach them once more from their hold, drop them into your vase, right them with a bit of stick, so that the sucking base is downwards, and leave them to themselves thenceforth.

*Actinia Dianthus** you may find adhering to fresh oysters in any dredger or trawler's skiff, a lengthened mass of olive, pale-rose, or snow-white jelly. The rose and the white are the more beautiful; the very maiden-queens of all the beautiful tribe. If you find one, clear the shell on which it grows of everything else (you may leave the oyster inside if you will), and watch it expand under water into a furbelowed flower, furred with innumerable delicate tentacula:† and, in the centre, a mouth of the most brilliant orange:

* On our shores it is rarely met with. It resembles *A. marginata* very closely.—Eds.

† See Gosse's Aquarium, Plate 5, p. 192.

altogether one of the loveliest gems, in the opinion of him who writes, with which it has pleased God to bedeck his lower world.

But you will want more than these anemones, both for your own amusement and the health of your tank. Microscopic animals will breed, and will also die; and you need for them such scavengers as our friend *Squinado*. Turn, then, a few stones which lie piled on each other at extreme low-water mark, and five minutes' search will give you the very animal you want,—a little crab, of a dingy russet above, and on the underside like smooth porcelain. His back is quite flat, and so are his large angular-fringed claws, which, when he folds them up, lie in the same plane with his shell, and fit neatly into its edges. Compact little rogue that he is, made especially for sideling in and out of cracks and crannies, he carries with him such an apparatus of combs and brushes as Isidor or Floris never dreamed of, with which he sweeps out of the sea-water at every moment shoals of minute animalcules, and sucks them into his tiny mouth. Mr. Gosse will tell you more of this marvel, in his Aquarium, p. 48.

Next, your sea-weeds, if they thrive as they ought to do, will sow their minute spores in millions around them; and these, as they vegetate, will form a green film on the inside of the glass, spoiling your prospect; you may rub it off for yourself, if you will, with a rag fastened to a stick, but if you wish at once to save yourself trouble, and to see how all emergencies in Nature are provided for, you will set three or four live shells to do it for you, and to keep your subaqueous lawn close mown.

That last word is no figure of speech. Look among the beds of sea-weed for a few of the bright-yellow or green sea-snails. For the present, they will only nibble the green ulvæ, but when the film of young weed begins to form, you will see it mown off every morning as fast as it grows, in little semicircular sweeps, just as if a fairy's scythe had been at work during the night.

And a scythe has been at work; none other than the tongue of the little shell-fish; a description of its extraordinary mechanism (too long to quote here, but which is well worth reading) may be found in Gosse's Aquarium, p. 34.

A prawn or two, and a few minute starfish, will make your aquarium complete; though you may add to it endlessly, as one glance at the salt-water tanks of the Zoölogical Gardens and the strange and beautiful forms which they contain, will prove to you sufficiently.

You have two more enemies to guard against, dust and heat. If the surface of the water becomes clogged with dust, the communication between it and the life-giving oxygen of the air is cut off; and then your animals are liable to die, for the very same reason that fish die in a pond which is long frozen over, unless a hole be broken in the ice to admit the air. You must guard against this by occasional stirring of the surface (it should be done once a day if possible), and by keeping on a cover. A piece of muslin tied over will do: but a better defence is a plate of glass, raised on wire some half-inch above the edge, so as to admit the air. I am not sure that a sheet of brown paper laid over the vase is not the best of all, because that, by its shade, also guards against the next evil, which is heat. Against that you must guard by putting a curtain of muslin or oiled paper between the vase and the sun, if it be very fierce, or simply (for simple expedients are best) by laying a handkerchief over it till the heat is past. But if you leave your vase in a sunny window long enough to let the water get tepid, all is over with your pets. Half an hour's boiling may frustrate the care of weeks. And yet, on the other hand, light you must have, and you can hardly have too much. Some animals certainly prefer shade, and hide in the darkest crannies; and for them, if your aquarium is large enough, you must provide shade, by arranging the bits of stone into piles and caverns. But without light, your sea-weeds will neither thrive, nor keep the water sweet. With plenty of light you will see.

to quote Mr. Gosse once more (p. 259), "thousands of tiny globules forming on every plant, and even all over the stones, where the infant vegetation is beginning to grow; and these globules presently rise in rapid succession to the surface all over the vessel, and this process goes on uninterruptedly as long as the rays of the sun are uninterrupted.

"Now these globules consist of *pure oxygen*, given out by the plants under the stimulus of light; and to this oxygen the animals in the tank owe their life. The difference between the profusion of oxygen-bubbles produced on a sunny day, and the paucity of those seen on a dark, cloudy day, or in a northern aspect, is very marked." Choose, therefore, a south or east window, but draw down the blind, or throw a handkerchief over all if the heat become fierce. The water should always feel cold to your hand, let the temperature be what it may.

Next, you must make up for evaporation by *fresh* water. A very little will suffice, as often as in summer you find the water in your vase sink below its original level, and prevent the water from getting too salt. For the salts, remember, do not evaporate with the water, and if you left the vase in the sun for a few weeks, it would become a mere brine-pan. —*From Kingsley's Glaucus, or the Wonders of the Shore.*

A FEW SEA-WORMS.

BY A. S. PACKARD, JR.

OUR sea-side readers may simply shrug their shoulders in disgust at the prospect of becoming acquainted with creatures unfortunate enough to possess a few "poor relations," who have brought, either by their uncanny looks or disagreeable habits, disrepute upon the whole class of worms. We wish to put in a plea for the worm. Hear our evidence,

look at a few specimens of this much-abused race, hear the story of their life, their strange manner of increasing the annulate census, and judge, ye sea-side loiterers of the Worm's place in society. We are not levellers. A worms' a worm, a lobsters' a lobster, and a bees' a bee; and they are not convertible terms. The earth is made more beautiful by bees and the myriads of insects, for without their aid, as pollen gatherers, in fertilizing flowers and "setting" fruit, the world would be a poor sojourning place for that unsatisfied and uneasy animal who gives all other animals names. What would a fish-market be without lobsters and crabs, who, with their thousand allies, the shrimps, sea-fleas, and barnacles, are the scavengers of the sea? But with all these there is a void which worms can only fill. How could Old Neptune thrive without the Nereids, the Naides, and the Amphitrites to adorn his halls, deftly sweep the floors of his palaces, and in a thousand ways beautify and enrich his domain by their silent, unobtrusive ministry?

An hour's search among the tidal-pools and rocks at low-water mark, will give us ample material for a few moments' discourse. We turn over a stone half-buried in the mud, and in the wealth of life there sheltered, behold strange, crawling, leech-like worms, of livid flesh-color, or dark-green or blood-red, and usually long and narrow, and with the power of indefinitely extending their bodies when in search of food or actually taking it. There are various species of Flat-worms and Nemerteans which glide rapidly over the surface. They are smooth, round or flattened, pointed at each extremity, and it is with difficulty that the head can be distinguished from the tail, as the mouth is a minute slit on the under-side of the head, and the eye-specks (almost the simplest kind of eye known) are often absent. The body is not divided into joints, or rings, while it is capable of great extension. Charles Kingsley, in his "Glaucus, or the Wonders of the Shore," has graphically described this property in a Nemertean.

"There lies an animal as foul and monstrous to the eye as 'hydra, gorgon, or chimæra dire,' and yet so wondrously fitted to its work, that we must needs endure for our own instruction to handle and to look at it. Its name I know not (though it lurks here under every stone), and should be glad to know. It seems some very 'low' Ascarid or Planarian worm. You see it? That black, shiny, knotted lump among the gravel, small enough to be taken up in a dessert-spoon. Look now, as it is raised and its coils drawn out. Three feet—six—nine, at least; with a capability of seemingly endless expansion: a slimy tape of living caoutchouc, some eighth of an inch in diameter, a dark chocolate-black, with paler longitudinal lines. Is it alive? It hangs helpless and motionless, a mere velvet string across the hand. Ask the neighboring Annelids and the fry of the rock-fishes, or put it into a vase at home, and see. It lies motionless, trailing itself among the gravel; you cannot tell where it begins or ends; it may be a dead strip of sea-weed, *Himanthalia lorea* perhaps, or *Chorda filum*; or even a tarred string. So thinks the little fish who plays over and over it, till he touches at last what is too surely a head. In an instant a bell-shaped sucker mouth has fastened to his side. In another instant, from one lip, a concave double proboscis, just like a tapir's (another instance of the repetition of forms), has clasped him like a finger; and now begins the struggle: but in vain. He is being 'played' with such a fishing-line as the skill of a Wilson or a Stoddart never could invent; a living line, with elasticity beyond that of the most delicate fly-rod, which follows every lunge, shortening and lengthening, slipping and twining round every piece of gravel and stem of sea-weed, with a tiring drag such as no Highland wrist or step could ever bring to bear on salmon or on trout. The victim is tired now; and slowly, and yet dexterously, his blind assailant is feeling and shifting along his side, till he reaches one end of him; and then the black lips expand, and slowly and surely the curved finger begins

packing him end-foremost down into the gullet, where he sinks, inch by inch, till the swelling which marks his place is lost among the coils, and he is probably macerated to a pulp long before he has reached the opposite extremity of his cave of doom. Once safe down, the black murderer slowly contracts again into a knotted heap, and lies, like a boa with a stag inside him, motionless and blest."

But we will leave these lesser lights among creeping things and introduce to the reader a singular and beautiful creature (Fig. 1), which we first discovered just below low-water mark on the coast of Maine, but which has been found by some members of the Essex Institute on the piles of Beverly bridge, a rich hunting-ground for marine zoölogists. It is about an inch and a half long, rather stout in its proportions, and of a delicate pale-green mottled with a livid tint, and with irregularly scattered blackish dots and patches. When at rest, one might be readily excused if on a casual glance he should mistake the tail for the head, but when it glides slowly forwards, it protrudes a soft, somewhat irregularly conical head, which is capable of great extension, as at one moment it looks like nothing at all, and in less than another like a veritable head. Its eyes are little dark specs arranged in two Λ shaped lines. A little behind the eyes are given off a great profusion of long hair-like feelers, which curl around, and, when at rest, almost completely envelope its whole body. When it moves, the long pale feelers, centred with a line of delicate red, drag along after it, and perhaps aid the worm in its very slow gliding motion.

Fig 1.

Another worm, quite interesting in its habits, is the Hæmotorrhæa, or Blood-drop. We found it in company with the preceding worm just below low-water mark.

While looking over the results of an hour's search among the Laminaria or Devil's Aprons, we noticed among the roots what was apparently a drop of blood. Placing it in a saucer, it soon moved and slowly stretched out a few feelers of unequal length, fastened the bulging ends in front of it, and thus anchored by the sucker-like swollen ends of the tentacles, drew itself along, slowly travelling around its prison. Our figure (2) represents it twice its natural size. The head and tentacles are of a paler red than the rest of the body, along each side of which is a row of short bristles, which aid it in moving in and out of its little rudely constructed tube of particles of sand, for we soon found, that, like the Terebella, it buried itself in the sand, leaving only the feelers exposed.

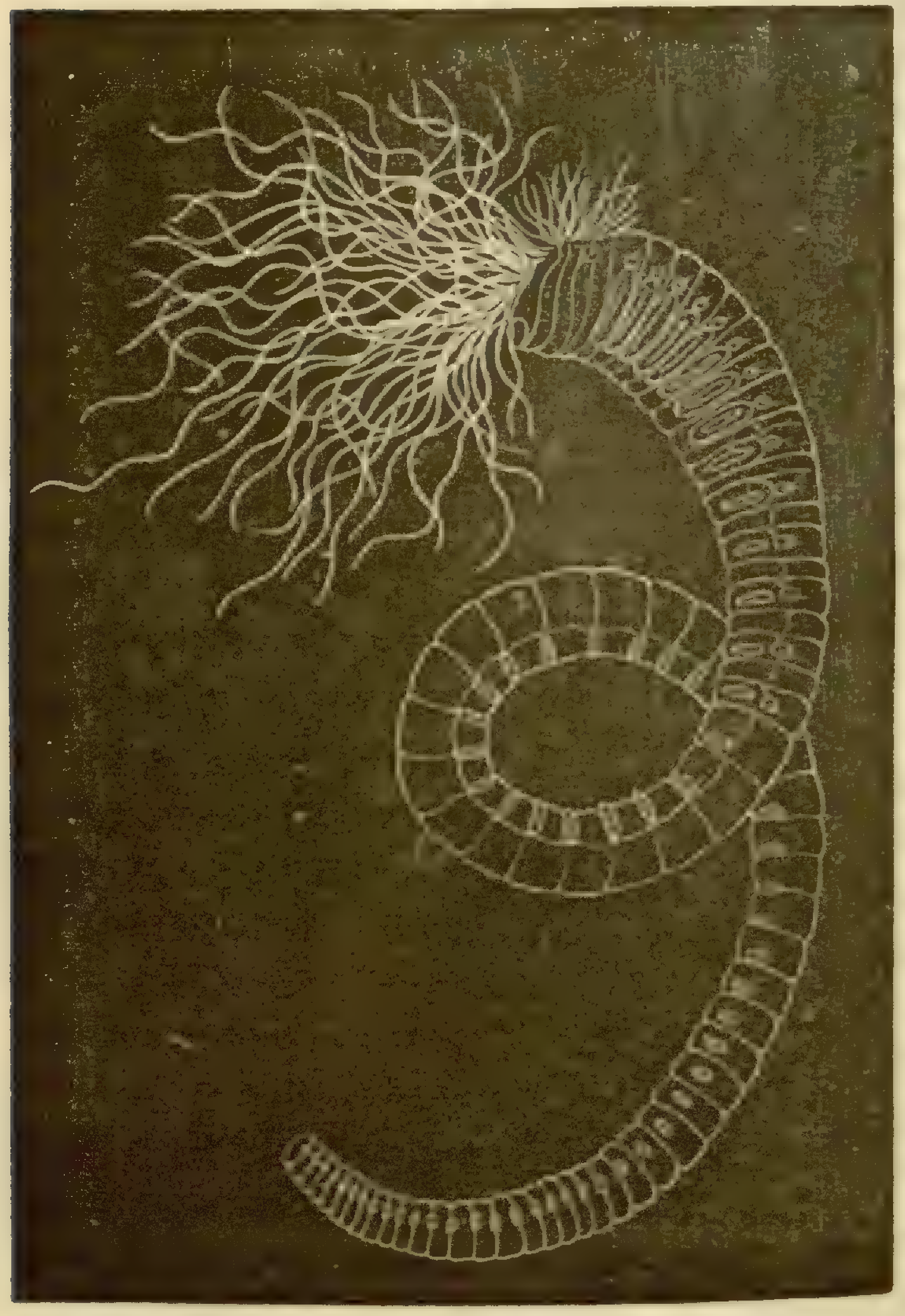
Fig. 2.

Many worms dwell in tubes, where their soft bodies are protected from prowling crabs and flesh-eating snails. Such are the Serpulas, which secrete a limestone shell fitting to the body, and usually curved like a ram's horn, while the tube of the Sabella, a beautiful worm, is leathery, or sometimes horny. An example of the latter is the case of a Spiochætopterus (if the reader will excuse the length of the name, no fault of the worm however), fragments of which we have dredged at a great depth, over fifty fathoms, in a deep fiord on the coast of Labrador, and which has been found on the coast of Norway by Professor M. Sars, over a foot in length and not a tenth of an inch in diameter. The *Amphitrite cirrata* (Fig. 3) is a curious tube-dweller. We have dredged it abundantly in the harbor of Eastport, Maine, that spot favored by fogs, cold storms, and icy sea-currents, where the temperature of the land and sea so nearly agree that low spring-tides reveal a wealth of life which in less-favored spots are hid far below low-water mark, and can be reached only by that uncertain means, the dredge.

Our figure, copied from Malmgren's (a Swedish naturalist) recent work on the worms of the Polar sea, relieves us from

giving a long description of this interesting worm. On being removed from its long flexible tube of mud, its thick body is seen to consist of seventy-five to eighty-five rings, with a profusion of long tentacles, and a mass of short branchiæ, or gills, behind the head; behind which is a short row of flattened tubercles, from each of which spring a fine bristle, that aids the animal in moving in and out of its case. There is also another row of flattened tubercles along the whole length of the body. These tubercles probably enable the animal to keep firmly within its tube, and when contracted allow it to move partially out of it.

Fig. 3.



We observed several tentacles which had been accidentally torn off, wriggling about the saucer as if actually living. Lewes (Sea-side Studies, p. 59) found that they retained the power of motion for six days. But should many of these feelers be cut off our Terebella, or Amphitrite, would soon be able to reproduce them, and not only this, but it has the

power, according to Lewes, of throwing off another individual like itself, by a process analogous to the budding of leaves on a plant. But let us hear Mr. Lewes himself speak:

"No one, I believe, has yet recorded the fact of the Terebella multiplying itself by the process of gemmation, which is known to occur in the case of some other Annelids,—such as the *Nais*, the *Syllis*, and the *Myriana*.* When the animal reproduces by this budding process, it begins to form a second head near the extremity of its body. After this head other segments are in turn developed, the tail, or final segment, being the identical tail of the mother, but pushed forward by the young segments, and now belonging to the child, and only vicariously to the mother. In this state we have two worms and one tail. It is as if a head were suddenly to be developed out of your lumbar vertebræ, yet still remain attached to the column, and thus produce a double-headed monster, more fantastic than fable. Or suppose you were to cut a caterpillar in half, fashion a head for the tail half, and then fasten this head to the cut end of the other half,—this would give you an image of the Syllis budding. But in some worms the process does not stop here. What the mother did, the child does, and you may see at last six worms forming one continuous line, with only one tail for the six. The tail indeed is the family inheritance: but reversing the laws of primogeniture, it always descends to the youngest. Such, in a few words, is the budding of annelids. I omit differences, and many curious details, only desiring to fix the reader's attention on the cardinal fact. The separation finally takes place, and then we perceive the children and grandchildren are not quite the same as their ancestor. The fact has not been observed at all hitherto in the group of annelids named *Tubicola*; yet two of my *Terebellæ* gave me a sight of it. The first died before the separation took place. The second, after a day or two's

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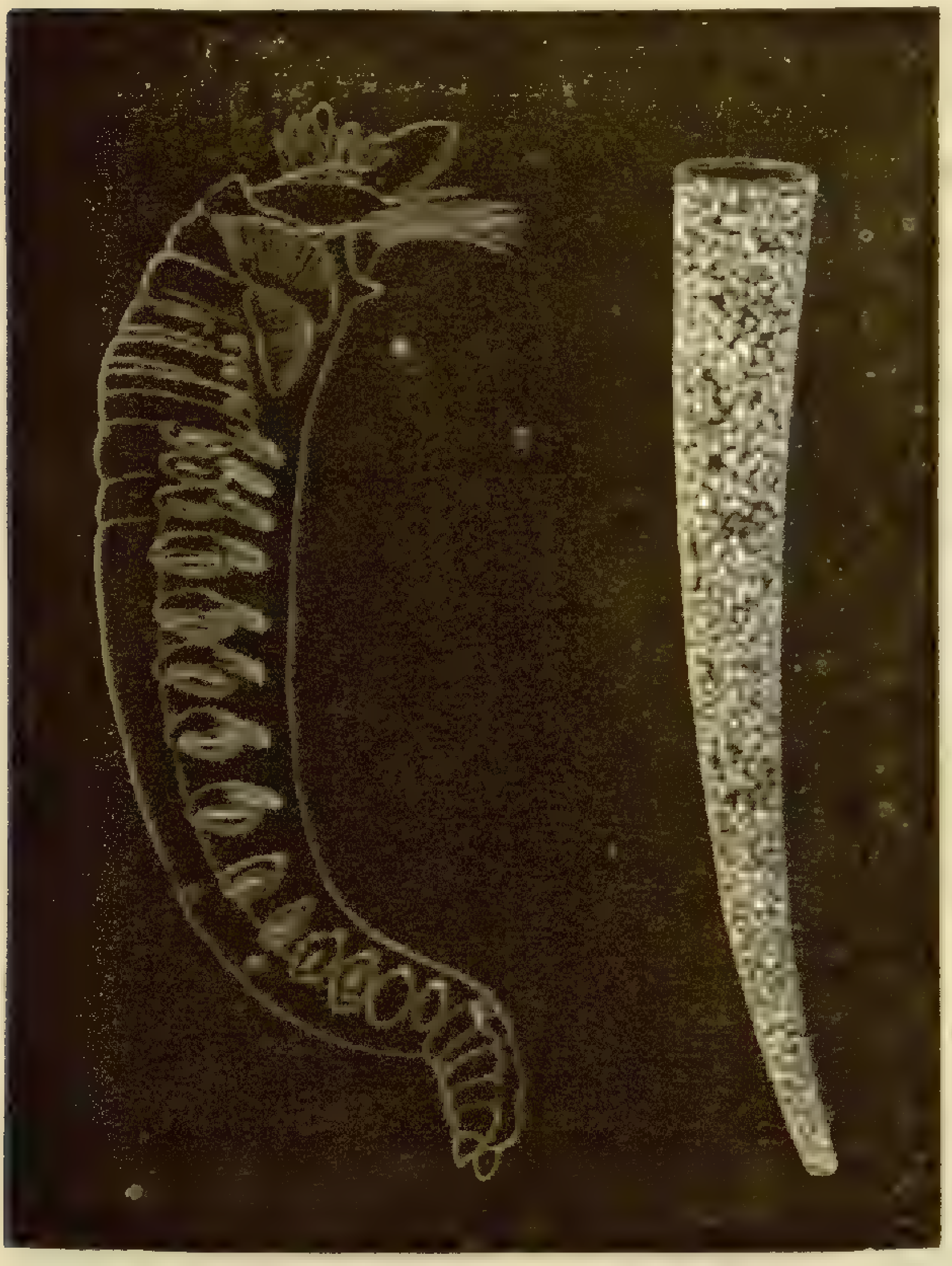
*For an account of this mode of reproduction in worms, see Clark's "Mind in Nature," published by D. Appleton & Co., New York.

captivity, separated itself from its appendix of a baby, and seemed all the livelier for the loss of a juvenile which had been literally in that condition of 'hanging to its mother's tail,' which I have heard applied in metaphorical sarcasm to small boys anxious to be with their mothers. The young one only lived four days."

Another tube-dweller is the Pectinaria (Fig. 4, *Pectinaria hyperborea* of Malmgren, and its slightly curved conical tube), which is found on our coast in deep water, and its empty tube sometimes at low water. So far as we are aware it does not protrude far out of its tube, but only exhibits a few short tentacles and a pair of the most brilliant comb-like set of golden bristles, from twelve to fourteen in each set. It is from one to two inches long, and its slightly curved tube is made up of little particles of sand so arranged as to present a smooth, almost shining, surface both within and without. We have dredged this species most abundantly in deep, quiet, muddy bays, where it feeds on fish-offal thrown from the fishing vessels. It grows of a smaller size southward, and is scarcely as common on our shores as in the arctic seas.

Fig. 4.



But the most brilliant and gorgeous sea-worms are the Nereids. Dig down a few inches into the mud between tide-mark and you will speedily turn up the *Nereis denticulata* of

Stimpson, a common worm on our shores. In this worm the head is larger and more distinctly separated from the rest of the body than in the others we have mentioned, and it is provided with two pairs of eyes and six or eight pairs of tentacles, while along each side of the body is a row of oar-like feet, expanding above into broad, oar-like, swimming organs, and furnished beneath with several bristles and fleshy filaments like feelers. The whole worm is radiant with all the colors of the rainbow reflected from its pearly body.

Some of these Nereids are of enormous size. We have found in the Bay of Fundy portions of the *Nereis grandis* of Stimpson, which is seventeen inches in length, and an allied form (*Eunice gigantea* Cuvier) grows in the Indian Ocean to a length of over four feet. These are the princes among worms, ranking above the smaller forms by their superior size and organization, and their rich imperial dress.

REVIEWS.

Good Books for the Sea-side. — We cannot better close our sea-side number of the Naturalist than by enumerating a few books on the common objects of the sea-side. We regret that more has not been done for the amateur sea-side naturalist by American writers. The shells of the shores of New England have been described by the late Dr. Gould in his Invertebrates of Massachusetts, originally published by the State, of which there is a new edition in preparation, to be illustrated with an abundance of first-class wood engravings, and several lithographic plates. It is to be hoped that the Legislature will see fit to order a large edition to be printed, as we learn the work is not to be stereotyped, and is not to be placed on sale, public libraries only being supplied. Otherwise, the book will not fall into the hands of naturalists, the future generations of which will be numbered by thousands, where they can now be counted by the hundred. The publication of Harris's Injurious Insects, which was stereotyped and is now rapidly selling, several editions having been struck off, was of incalculable advantage to the State from an educational point of view, and the stereotyping of the new edition of Gould's Invertebrates is a public necessity. If each legislator is to have a copy

free gratis, pray why may not naturalists have the right to pay $5, or whatever the price may be, for a copy?

Our only truly popular book is "A First Lesson in Natural History, by Actæa," prepared under the direction of Professor Agassiz, and illustrated with numerous wood-cuts. Within a compass of eighty-two pages are pleasant talks about Sea-anemonies and Corals, Coral Reefs, Hydroids and Jelly-fishes, Starfishes and Sea-urchins. A more solid book and full of scientific novelties is Mrs. E. R. and Mr. A. Agassiz' Sea-side Studies, a beautifully printed and illustrated work on Hydroids and Jelly-fishes,— an indispensable hand-book to those beautiful forms. These two works form a fitting introduction to the four volumes of Professor Agassiz' great work on the Natural History of the United States, the third and fourth volumes of which are on the radiated animals of our coast, mostly comprising the Polyps and Jelly-fishes.

Many of these and other marine animals are described in Professor Clark's "Mind in Nature," a work which every student of nature should read. It contains many illustrations drawn by the facile pencil of the author. Professor Tenney's "Zoölogy for Schools" contains many admirable wood-cuts of our common fishes and marine animals, and this work must go into the library of the sea-side tourist. The student of marine zoölogy cannot do without Dr. Stimpson's Marine Invertebrates of Grand Menan (an island lying at the mouth of the Bay of Fundy), which was published by the Smithsonian Institution, whose Contributions to Science also contain Harvey's great work on the Sea-weeds of North America, abundantly illustrated with colored plates representing our marine flora. Numerous other papers on sea-animals are scattered through the Proceedings and Memoirs of our scientific societies, especially those of Charleston, Philadelphia, New York, New Haven, Boston, Salem, and Portland. The Illustrated Catalogues and Bulletins of the Museum of Comparative Zoölogy at Cambridge, are also invaluable to those who wish to study these animals more thoroughly.

In lieu of popular American books there are several English works to be recommended. The animals they describe resemble ours in habits, and though differing specifically from those of our coast, these books will fill an important vacancy in our sea-side literature. "First and foremost, certainly," writes Charles Kingsley, come Mr. Gosse's books:

"There is a playful and genial spirit in them, a brilliant power of word-painting, combined with deep and earnest religious feeling, which makes them as morally valuable as they are intellectually interesting. Since White's 'History of Selborne,' few or no writers on Natural History, save Mr. Gosse and poor Mr. E. Forbes, have had the power of bringing out the humorous side of science, and giving to seemingly dry disquisitions and animals of the lowest type, little touches of pathos and humor, that living and personal interest, to bestow which is generally the special function of the poet: not that Waterton and Jesse are not excellent in this respect, and authors who should be in every boy's library: but they are rather anecdotists than systematic or scientific inquirers; while Mr. Gosse, in his 'Naturalist on the Shores of Devon,' his 'Tour in Jamaica,' and his 'Canadian Naturalist,' has done for those three places what White did for Selborne, with all the improved appliances of a science which has widened and deepened tenfold since White's time.

"Miss Anne Pratt's 'Things of the Sea-coast' is excellent; and still better is Professor Har-

vey's 'Sea-side Book,' of which it is impossible to speak too highly; and most pleasant it is to see a man of genius and learning thus gathering the bloom of his varied knowledge, to put it into a form equally suited to a child and to a *savant*. Seldom, perhaps, has there been a little book in which so vast a quantity of facts has been compressed into so small a space, and yet told so gracefully, simply, without a taint of pedantry or cumbrousness,—an excellence which is the sure and only mark of a perfect mastery of the subject.

"Two little 'Popular' Histories, one of British Zoophytes, the other of British Sea-weeds, by Dr. Landsborough, are very excellent; and are furnished, too, with well-drawn and colored plates, for the comfort of those to whom a scientific nomenclature (as liable as any other human thing to be faulty and obscure) conveys but a vague conception of the objects. These may serve well for the beginner, as introductions to Professor Harvey's large work on the British Algæ, and to the new edition of Professor Johnston's invaluable British Zoophytes."

To these we may add "Quatrefages' Souveniers of a Naturalist," a fascinating work by a first-class observer, on the animals of the coast of France and of the shores of the Mediterranean, republished in London.

NATURAL HISTORY MISCELLANY.

ZOÖLOGY.

INSECTS LIVING IN THE SEA.—Insects are essentially earth-inhabiting. A small proportion of all the insects live in fresh water, and less than a hundred are known to inhabit the sea. Only three species are known to inhabit the sea in this country. A year ago in August, while dredging in Salem harbor, we detected the larvæ of a species of fly living on the floating eel-grass, and apparently living on the vegetable matter collected on

Fig. 1 *a*.

Fig. 1

Fig. 2.

it. The twentieth of September they transformed to pupæ (Fig. 1; 1*a*, forefoot of the larva), and on the ninth of October appeared the fly (Fig. 2, male, and beneath, head of the female with simple antennæ), the male of which has beautifully pectinated antennæ, and belongs to the genus *Chironomus*. We have since found the full-grown

larva living in abundance at low-water mark among the green sea-weeds late in April. They must have hatched from eggs laid in the autumn.

Another insect (Fig. 3) we have found late in April at low-water mark, in Casco Bay, Maine, and, like the Chironomus, living in the green sea-weed. It is, probably, the larva of some Rove-beetle (*Staphylinus*), and as suggested to us by Dr. Stimpson, is, perhaps, the larva of *Micralymna*, a beetle known in Europe to inhabit the sea.

In this connection we figure the brine-inhabiting Ephydra (Fig. 4, side-view of the fly; 4*a*, wing; 4*b*, side-view of the puparium or pupa-case), which, according to Mr. E. T. Cox, from whom we have received specimens, lives in the very strong brine of the "Graduation House," at the Equality Salt-works, Gallatin County, Illinois. Dr. T. d'Oremieulx has sent us a puparium hardly distinguishable from the Illinois one, which he collected under the sea-weed on the shores of Narragansett Bay; so that we have here another sea-inhabiting insect.

Fig. 4.

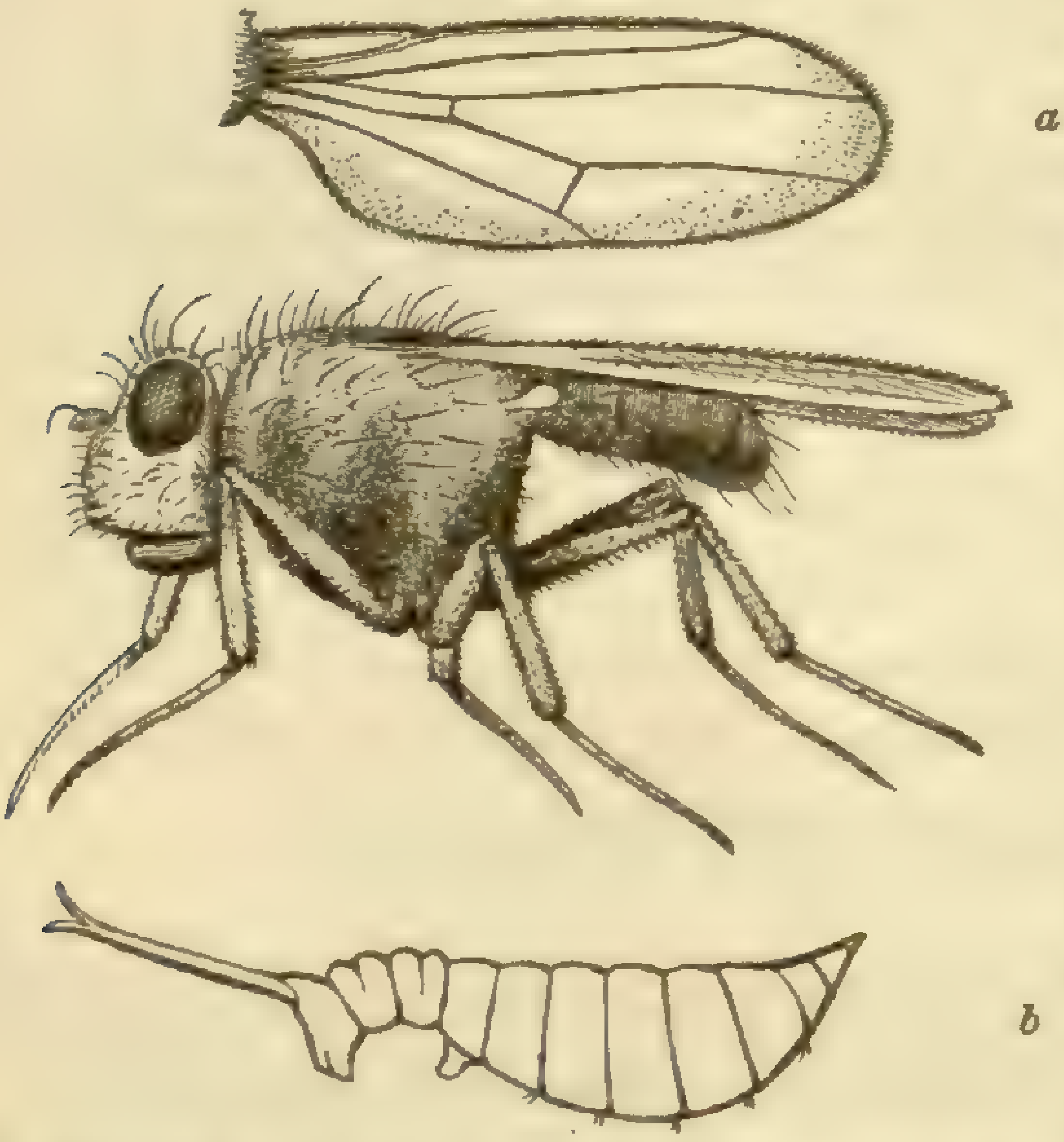


Fig. 3.

We figure (5) the pupa of *Eristalis*, or Rat-tailed fly, which is found with the Ephydra, at the Equality Salt-works. Mr. Horace Mann has found immense numbers of a similar insect in the briny waters of Mono lake, California, and it is not improbable that some of these curious flies will be found to inhabit our shores between tide-marks. — A. S. P.

Fig. 5.

Directions for collecting the Lower Forms of Marine Animals. —The collector must be acquainted with the fact that the sea has distinct zones of animal and plant-life. Thus, between high and low-water mark certain species occur. From low-water mark to fifteen fathoms another set is found peculiar to that zone. Beyond these depths other zones occur. In collecting between high and low-water mark, the collector must visit the different kinds of shores. Thus on a rocky and exposed shore, particular attention must be paid to the pools left by the tide; those nearest low-water mark will always be found the richest. Having selected a proper pool for examination, let him lie down flat upon the rocks, first taking a survey of the pool before disturbing it. Having observed or collected what free swimming animals he chooses, he may then lift carefully (in order not to rile the water), one by one, the

loose fragments of rocks that possibly cover the bottom, and examine their lower surfaces. Here he will find many curious and interesting shells, some of them minute; the brittle starfish, several kinds of worms, and above all those elegant sea-slugs, little animals closely allied to the snail, only having no shell. Many other forms will be found in such haunts by careful searching. On these rocky shores the collector should take advantage of the low spring and fall tides, for then a portion of another zone of animal life will be exposed to him, and he will find many novelties. Never leave a stone unturned in such places, for marine animals are proverbially shy, and prefer seclusion. He must also take advantage of the heavy storms that beat upon the coast, and along the beaches after one of these storms he may pick up many rarities. In fact he may find certain species washed up in the greatest profusion, that he will rarely meet with at other times. The long mud-flats will repay him a muddy tramp at low water, for, crawling over the mud, or buried just beneath its surface, he will find certain mollusks and worms peculiar to such places.

One of the richest fields for collecting near cities will be found on the piles of any exposed pier, or bridge. We mean by exposure, a structure that stands in deep water where the ocean has more or less direct access to it, protected at the same time from the heavy wash of the sea by some outlying island or cape. Let him take a small boat, and, armed with a net having a stout wire frame affixed to a pole ten feet long, he may drag up at low tide from the sides of the piles by a slow raking motion, a perfect harvest of sea-anemones, sea-urchins, starfishes, shells, crabs, worms, and a legion of other forms that will keep him busy for some time.

An outfit for a collector is, first of all, a basketful of wide-mouthed bottles, pickle jars will answer the purpose, a pair of forceps, a good pocket lens, unless he carries it in his head, a case-knife to detach certain animals from the rocks; a few little pocket vials will not come amiss. For collecting animals beyond the limits described, the collector must possess a dredge, the simplest form of which is a triangle made of iron; the longest side sharpened on one edge to act as a scraper. To this iron a bag of netting is affixed. Supplied with a good manilla rope, he may dredge to the extent of his line, and the assemblage of animals will be quite unlike those that he has met with in the zones mentioned above.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

SOCIETY OF NATURAL HISTORY, *Portland, Me., May* 7.—The rare shell, *Helix multidentata*, before known only by a few specimens, was reported as occurring abundantly in a wood on Cape Elizabeth. The most inter-

esting event of the meeting was the presentation of a Pteropod (*Clione borealis*), a marine animal of the arctic seas, which has been discovered by Mr. C. B. Fuller in large quantities in our harbor. This animal belongs to a division of the Mollusca called Pteropoda, or "Wing-foot," from the swimming appendages which resemble the organs of flight of birds. Only six species are known to occur on the coast from the arctic seas to Georgia. They are most abundant in the extreme northern or southern oceans. Some possess a delicate glassy or horny shell, while Clione is entirely naked, and of a consistency not much greater than that of the common jelly-fish. It is a very singular sight to observe their evolutions in a jar of sea-water. The Clione moves with a deliberate and graceful motion of its wings — almost recalling the action of a dexterous human swimmer. The Limacina, another pteropod observed by Mr. Fuller, and collected with the Clione, uses its wings much more nervously, and gambols about the jar like a miniature and half-fledged robin.

It is not known that the Clione has ever been seen so far to the southward before. Packard reports it as abundant on the coast of Labrador. This is probably the extreme southern limit of the species, and we are no doubt indebted to the persistency of our "cold term" for these fairy-like visitors in our harbor. Is our climate so changing its temperate quality that arctic animals find in our waters a congenial home?

American Association for the Advancement of Science. — The next meeting will be held at Chicago the last of August. It promises to be an unusually interesting meeting, and we hope it will be largely attended. Various excursions by the members are contemplated, of which, however, we have not received precise information in time to insert in this number.

CORRESPONDENCE.

R. H. F., Mt. Etna, Ind. — The plant you send appears to be the *Lemna*, or Duckweed.

W. V. A., New York. — The solvent for reeling the cocoons of the Cynthia Silk-moth, given by Guèrin Menneville, is: some carbonate of potash in boiling water, with an addition of white soap; no proportions given. — L. T.

E. O., Yellow Springs, O. — You write that "we are enjoying a visitation of the seventeen-year locust. The first perfect insect appeared on May 18th. The ground is full of the larvæ." We would be greatly obliged for branches of the oak showing the mode of laying the eggs, and for alcoholic specimens of the larvæ of different sizes, and of the pupa and adult. We can name a few of the beetles you send now, and will send you the names of the others in a few weeks. 1. *Nebria pallipes*; 3. *Pangus caliginosus*; 4. *Dicælus purpuratus*; 5. *Ochthedromus antiquus*; 13.? *Clivina pustulata*; 16. *Pœcilus chalcites*; 18. *Harpalus* near *amputatus* Say; 20. *Oiceoptoma marginata*; 22. *Silpha inæqualis*; 24. *Staphylinus villosus*.

BOOKS RECEIVED.

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The Butterflies of North America, with Colored Drawings and Descriptions. By Wm. H. Edwards. Philadelphia. Part I. April, 1868. 4to, with five plates, $2.00.

Cosmos. April 18, May 9, 16. Paris.

Land and Water. April 4, 11, 18. London.

The Field. April 25, May 2, 9, 16. London.

Entomologist's Monthly Magazine. June to December, 1866, 1867, January to March, 1868. London.

THE

AMERICAN NATURALIST.

Vol. II.—AUGUST, 1868.—No. 6.

TRACES OF ANCIENT GLACIERS IN THE WHITE MOUNTAINS OF NEW HAMPSHIRE.

BY GEORGE L. VOSE.

PROBABLY few of the tourists who ride up the valley of the Androscoggin, from Bethel to Gorham, upon a hot August afternoon, would be quite prepared to believe that at some former period a solid river of ice filled that valley, for hundreds of feet in depth, and many miles in length, moving with a slow but irresistible march downwards, and that this huge glacier was continually supplied with fresh material at its upper end, from the vast snow-fields beneath which the White Mountains were perpetually buried. Yet there is evidence upon the ground that such was the case. All along the route the rocks are carved with hieroglyphics, more ancient by far than those of Egypt and the Nile, which, by means of the key obtained in the Alps, we are enabled to read.

In the mountains of Switzerland and of Italy, immense bodies of snow accumulate in the more elevated regions, where it is so cold that melting to any considerable extent is impossible, even in the summer. This snow is by a very gradual process converted into ice, immense bodies of which fill the higher Alpine valleys, and, urged by the pressure of

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the unconsolidated snow at the upper part of the mass, move down at the rate of from three hundred to five hundred feet in a year. The moving of a mass of ice, it may be a dozen miles in length, a mile wide, and a thousand feet deep, is attended by a tremendous grinding upon the rocks over which the glacier passes. By extended examinations geologists have become convinced that in old times these great bodies of ice covered immense tracts where now no ice is seen, and nothing but the polishing and scratching upon the ledges remains. This furrowing and polishing resembles so exactly the results now being produced beneath the present glaciers of the Alps, as to be regarded as positive evidence of the movement in a former age of vast bodies of ice over the rocks so scored.

There is at first sight a marked difference between the glacial furrows and polishing in the Old World and in the New. In Europe these marks upon the rocks are found in certain mountain regions, and always referring us by their direction to the higher parts of the mountain groups; thus showing that the glaciers moved down from the higher to the lower lands. This is plainly seen in the Alps, in Scandinavia, and Great Britain. In America, the traces upon the rocks, as a general thing, appear to have been produced by a far more wide-spread operation, inasmuch as the furrows have a prevailing southerly direction, regardless of topographical features to a remarkable extent, as they pass directly over and across some of the largest ranges of mountains. Throughout New England, the most common course of the furrows is about S.S.E. The wide extent of these traces would seem to point to some very general operation as a cause. What this operation was, or rather precisely how it worked, is by no means yet understood by geologists; nor does it concern us here, as the object at present is to call attention to a different class of glacial traces, which appear to show, contrary to the opinion for a long time held, that besides this general operation, which may be

traced over so wide an area, there have been what may be termed local glaciers,—masses of ice which belonged especially to certain mountain groups, and moved down the large valleys, leaving marks upon the rocks over which they passed, according in direction with the course of the valleys, and varying widely from that of the prevailing north and south traces.

The White Mountains of New Hampshire, both from their height and their northern latitude, give us reason to suppose that if local glaciers ever existed in New England, their traces would be found in the valleys of this group. The late Dr. Edward Hitchcock predicted that such would be the case. Dr. A. S. Packard, of Salem, after an examination of the eastern slope of the White Mountains, concluded that glaciers had, during some former period, radiated from the higher summits. The reader is particularly referred to his article in the first volume of this Magazine, as the glacial traces there referred to are laid down upon the map accompanying this paper, and as a section of the mountains but little known is there described.

It is to a part of the Androscoggin Valley, and to the upper part of its tributary, the Peabody River, that attention is here called, as facts plainly seen upon the ground seem to show that a glacier moved from Mount Washington down to the point where Gorham now stands, and that it joined at that place another large glacier, moving down the Androscoggin almost twenty miles, to Bethel.

The general course of the Androscoggin River, from its source to its mouth, is south-east; but this general course is made up of local courses which differ widely in direction. From its junction with the Megalloway, west of Umbagog Lake, to Gorham, thirty miles, it flows from north to south: from Gorham to Bethel, twenty miles, it flows from west to east; at Bethel it turns abruptly round and flows for six miles north, and from the point thus reached east for thirty miles, but with great local variations; thence thirty miles

south to Lewiston, and from that place twenty-five miles south-east, through Lisbon and Brunswick, to its junction with the Kennebec above Bath.

Now, while the glacial traces in the north and south reaches of this river might have been made either by the general operation which has polished off the whole country, or by a local glacier confined to the valley, such could hardly be the case with any furrows which may be found coinciding with the general direction of the east and west reaches. Let us look at the Androscoggin Valley, from Bethel in Maine, to Gorham in New Hampshire. This part of the river flows, for twenty miles, from west to east, and is bounded on both sides by abrupt hills from 1,000 to 2,000 feet high. At Bethel the valley opens, the hills receding and decreasing in elevation. Where glacial furrows are found upon the tops of the Bethel hills, they run nearly north and south. Proceeding up the valley towards Gorham, upon the south (right) bank, at a point about two and a half miles above Bethel, before we really enter the close valley, and perhaps a hundred feet above the level of the river, a small exposure of rock is seen directly in the common road, being about six feet square, with a long gently sloping polished surface towards the north, and a steep and rough face towards the south. The furrows upon the smooth northern surface run north and south, and the hills upon the summits of which the furrows run north and south, lie exactly north of this rock, upon the opposite side of the river. This furrowing had evidently no connection with the Androscoggin, as the grooves point almost directly across it. Continuing up the valley, just above Pleasant River, five miles above Bethel, about one-fourth of a mile south of the road, and perhaps two hundred feet above the river, the rocks are well polished; and from faint lines upon masses of quartz, the direction of the ice is seen to have been S. 50° E. Six miles above Bethel, where the river, railway, and road, draw closely together, and sweep round the base of Peaked Hill,

in Gilead, in the railroad cutting just between the two crossings of the common road, there is a steep ledge about twenty feet high, close to the track, which is polished and furrowed both upon the nearly vertical face towards the river, and also upon a narrow horizontal shelf part way up on the ledge. The lines upon the horizontal shelf run S. 20° E., the vertical face standing S. 25° to 30° E. It is necessary, however, to be guarded in drawing conclusions from glacial traces left upon vertical or steeply inclined surfaces; as the movement of ice, jamming through a narrow passage, may be locally disturbed, so as to give a direction to the furrows quite different from that of the general movement of the glacier. This was most likely the case at the point above referred to; as the furrows on the opposite side of the hill, *i. e.* the south side, run S. 80° E.; thus according much more nearly with the traces both above and below this point than the furrows upon the steep face towards the river do. The ice would seem to have passed around both sides of this hill; and we can readily conceive that this might be, since the depression in the rear, south of the elevation, is quite low. Indeed, in the fine view from "Sunset Rock," in Bethel, looking up the Androscoggin, Peaked Hill seems to rise in a very isolated manner from the middle of the valley, which makes it a very prominent feature in that magnificent picture.

Continuing up towards Gilead, about a mile above Peaked Hill, and eight miles from Bethel, at a point where the mountains crowd in close upon the river, there occurs a little south of the road, and it may be three hundred feet above the river, a large, steeply inclined, and magnificently polished surface, which is very plainly seen from the road a mile and a half below, as it sweeps around the western base of Peaked Hill. This surface shows a very few faint lines; but just below it may be seen well-defined furrows upon quartz, running S. 55° to 60° E. At a little more than nine miles from Bethel, upon the side of the common road, where

it bends again around a mountain spur, furrows are seen upon a small exposure running s. 80° e. At Gilead, ten miles from Bethel, just north of the railroad woodshed, and near the Androscoggin River, furrows are seen upon a highly polished surface of quartz, running s. 40° e., and a few rods east of this ledge, are some very good examples of erratic blocks; though from their lithological character they have apparently not come from any great distance. Between the railroad station and the old Wild River bridge, may be seen a good example of a polished rock, with a long, smooth, gentle slope to the north-west, and a rough, short, broken face to the south-east; but lacking indications of the precise direction of the movement of the polishing agent. About a mile above Gilead station, at the base of Mount Ephraim, where the road and the railroad draw close together and bend around the mountain, just south of and close to the road, at a small quarry, are well-marked lines in quartz, running s. 70° e.

The several traces above referred to, may be seen by reference to the map, in the positions which they occupy in respect to the course of the river. They follow the general direction of the Androscoggin Valley at this place, and are nearly at right angles with the course laid down by Dr. Packard upon the summit of Speckled Mountain (5). The remaining part of the valley, from Gilead through Shelburne to Gorham, as well as the whole reach from Gorham to Bethel upon the northern bank, invites examination; additional traces will doubtless be found, supporting the conclusion that a large glacier once moved down this portion of the Androscoggin. Especially interesting seem to be the isolated Peaked Hill (3), and the abrupt and inviting summits of Mount Ephraim, just above Wild River (4); and should no glacial traces reward the time spent in examining these points, the explorer would be amply repaid for his labor by the superb panorama which he will see spread out beneath him.

Mount Hayes, which rises about 1,200 feet above the village of Gorham, and thus 2,000 above the sea, shows upon its summit furrows running S. 40° E. This elevation affords an excellent view of portions of the Androscoggin and Peabody Valleys, and gives a more correct idea of the general relief of the surface in that region than can be obtained elsewhere. The towering pyramids of Madison and Adams are also seen from this point to great advantage, and, altogether, Mount Hayes offers every inducement to those fond of an active tramp and fine scenery.

The Peabody River rises upon the eastern slopes of Madison, Adams, Jefferson, Clay, and Washington, and upon the western slopes of the opposite range of the Carter Mountains, the Imp, and Mount Moriah; and flows about N. N. E. to Gorham, where it joins the Androscoggin. The surface geology of this valley is exceedingly interesting; it has been carefully studied by Dr. Packard, and, from the arrangement of its terraces and the other forms of the unconsolidated material, he concluded that a large glacier once occupied this valley, extending as far down as to Gorham. His conclusion is somewhat confirmed by the following facts: About one hundred and fifty yards north of the Glen House, just south of a large boulder upon the west side of the road, the surface has been cut open, and has exposed a portion of a ledge, perhaps a dozen feet in length and a yard wide, on which, at right angles to the contorted lamination of the rock, faint lines, or rather furrows, are seen running N. 35° E., or S. 35° W. This ledge was covered several feet deep by the material of the terrace in front of the Glen House. Just across the valley from the hotel, where the carriage road commences to ascend, the upper part of the large exposure on the right hand is well polished and furrowed, in a south-west direction. Half a mile farther up the road, furrows upon the right side, close to the road, are seen running S. 40° W., or N. 40° E., and again a short distance above the path leading to Tuckerman's Ravine, upon a surface

somewhat inclined towards the road, may be seen lines running s. 30° w., or n. 30° e. Many more traces would doubtless be found in this neighborhood if sought for with care: as the few recorded were noted without stepping out of the common road.

Thus it appears that while the glacial furrows in the Androscoggin Valley have courses ranging from s. 20° e. to s. 80° e., those of the upper part of the Peabody Valley range from s. 30° w. to s. 40° w.; making a general difference betwçen the courses in the two valleys of over 80°; a difference equal to that between the two valleys themselves. We may, it would seem, thus conclude that a large glacier moved from the neighborhood of Mount Washington down towards Gorham; and that another moved from Gorham down the Androscoggin Valley, at least as far as to West Bethel.

In the depression between the higher summits of the White Mountains, especially between Clay and Jefferson, Munroe and Washington, and at the foot of Mount Franklin, the rocks are rounded and polished from the north and north-west. A little above the Lake of the Clouds, directly in the Crawford bridle-path, faintly defined furrows may be seen running nearly north and south; this point would be about 5,300 feet above the sea, according to the measurements of Professor Guyot. These elevated traces belong, not to any local glaciers, but to the general ice movement which swept over the whole of New England.

The White Mountains have been so scarred and torn by slides, the valleys so filled with rubbish, and the beds of the streams so excessively water-worn, that many of the glacial traces have most likely disappeared. Still, this region has been very little explored, and has yielded as much fruit perhaps, for the cultivation bestowed upon it, as any other. That part of the Saco Valley between Old Crawford's and Bartlett, and the parallel valley of Swift River, which drains a large area between Chocorua and the Mote Mountains, and

VOSE ON GLACIERS OF THE WHITE MOUNTAINS.

enters the Saco at Conway Corner, both running nearly from west to east, deserve to be carefully studied. The valley of Wild River, too, promises to afford traces of local glaciers whenever it shall be carefully explored.

We have called attention to the few facts which we have noticed in the eastern section of the White Mountains. We do not propose to theorize upon the relation between the general and the local traces at present. We prefer to await the farther accumulation of evidence which shall enable us to restore correctly the various phases of that cold period when vast snowfields filled the White Mountain basins, and huge glaciers ploughed along the White Mountain valleys, leaving those marks upon the rocks by which we judge of their former presence, those convincing illustrations upon the last page of the geological history of the globe.

DESCRIPTION OF THE MAP.

The district embraced by the accompanying map extends from Bartlett and Kearsarge on the south, to Gorham and Mount Hayes on the north; and from Bethel, in Maine, upon the east, to the White Mountain Notch on the west. It thus includes what may be termed the eastern slope of the central mass of the White Mountain group. This general eastern slope, it will be seen by a glance at the several streams, has an irregular water-shed, running from the Pinkham Notch a little north of east for about twenty miles, and afterwards running still more north of east so as to pass a little south of Bethel. Besides the Pinkham Notch, there are four passages across this water-shed; all accessible to those who are not afraid of a little rough walking, and all full of interest to lovers of wild natural scenery. The route from Jackson to Gorham, by the Pinkham Notch and the Glen, is familiar to all; but there is another mode of passing from Jackson into the Peabody Valley which few persons have tried. This is the route up the Wildcat Branch to its western source, in the Carter Notch (XII), and thence down the stream flowing north, out of the same notch, to its junction with the Peabody River, a short distance below the Glen House.

The second passage of the water-shed is made by following up the eastern source of the Wildcat Branch, and passing through the depression (XI) and striking the head of the Wild River; this may be followed to its junction with the Androscoggin at Gilead. This trip requires two days; and in starting from Jackson, the camp for the night should be well over into the Wild River Valley; otherwise the second day's journey will be

too long, as much of it must be made in the bed of the stream, at least as far as to the State line, after which there is a good foot-road down the right bank to Gilead.

The third passage is the one described by Dr. Packard, in the first volume of this Magazine, p. 265–267, from Chatham up the Cold River to Gilead. Chatham may be reached by crossing over the mountains from Jackson (v), or by going north from Lovell (viii) or North Fryeburg (vii).

The fourth passage is from Lovell up either side of Kezar Pond, through Miles' Notch (ix), and thence by Pleasant River to West Bethel on the Androscoggin.

The Roman numerals upon the map indicate the following points: i. Bethel; ii. Gilead; iii. Gorham; iv. The Glen House; v. Jackson; vi. Chatham; vii. North Fryeburg; viii. Lovell; ix. Miles' Notch; x. Evans' Notch; xi. Wild River Notch; xii. Carter Notch. The additional figures serve to define the following separate mountains: 1. Sparrow Hawk, in West Bethel; 2. Peaked Hill, in Gilead; 3. Calabo, in Mason; 4. Mount Ephraim, in Gilead; 5. Speckled Mountain, in Stoneham; 6. Mount Royce, 7. Baldface, both in Chatham; 8. Kearsarge, in Chatham and Bartlett; 9. Thorn Mountain, in Bartlett and Jackson; 10. Double-head, in Jackson; 11. Name unknown; 12. Wildcat; 13. South peak of Carter; 14. North peak of Carter, or Imp; 15. Moriah: these five last-named mountains are in the tract between Jackson and Shelburne, called Bean's Purchase; 16. Mount Hayes; 17. Camel's Hump, in Gorham; 18. Madison; 19. Adams; 20. Jefferson; 21. Clay; 22. Washington; 23. Munroe; 24. Franklin; 25. Pleasant; 26. Clinton; 27. Jackson; 28. Giant's Stairs; 29. Mount Resolution; 30. Mount Crawford, and 31, Mount Willard. The fourteen peaks last named lie in land granted to individuals, but never made into townships. Mount Crawford, Resolution, and Giant's Stairs lie in the old route, now abandoned, from old Crawford's to the summit of Mount Washington, joining the present Crawford bridle-path east of Mount Munroe.

The following figures show the elevation above the sea of some of the principal points upon the map, according to the barometrical measurements of Professor Guyot:

Androscoggin River, at Bethel, Me.,	632 ft.
Railroad Station, at Gorham, N. H.,	802
Glen House,	1,632
Peabody River, opposite Glen House,	1,543
Summit of road, Pinkham Notch, near Glen Ellis' Falls,	2,018
Hotel at Jackson,	771
Road at Junction of Saco and Ellis Rivers,	576
Old Crawford's (Davis'),	986
Willey House, White Mountain Notch,	1,335
Crawford House, White Mountain Notch,	1,920
Mount Clinton (26 on map),	4,320
Gap between Clinton and Pleasant,	4,050
Mount Pleasant (25 on map),	4,764

Gap between Pleasant and Franklin,	4,400 ft.
Mount Franklin (24 on map),	4,904
Mount Munroe (23 on map),	5,384
Gap between Munroe and Washington,	5,100
Lake of the Clouds, foot of Munroe,	5,009
Mount Washington (22 on map),	6,288
Gap between Washington and Clay,	5,417
Mount Clay (21 on map),	5,553
Gap between Clay and Jefferson,	4,979
Mount Jefferson (20 on map),	5,714
Gap between Jefferson and Adams,	4,939
Mount Adams (19 on map),	5,794
Gap between Adams and Madison,	4,912
Mount Madison (18 on map),	5,365
Limit of trees on north side of Washington, and on Madison,	4,150
Limit of trees on Clinton,	4,250
Mount Hayes (approximate) (16 on map),	2,000
Mount Moriah (15 on map),	4,653
Carter Mountain, north peak, or Imp (14 on map),	4,702
Carter Mountain, south peak (13 on map),	4,830
Wildcat Mountain (12 on map),	4,350
Double-head, north peak (10 on map),	3,100
Double-head, south peak (10 on map),	3,000
Kearsarge (8 on map),	3,500
Thorn Mountain (9 on map),	2,500
Giant's Stairs (28 on map),	3,500
Mount Resolution (29 on map),	3,400
Mount Crawford (30 on map),	3,134
Mount Jackson (27 on map),	4,100
Mount Webster (south of 27),	4,000

NOTE.—There are few persons among those who visit the Mountains who could not aid in obtaining evidence of former glaciers, if they were so disposed. A very little study will enable one to recognize the marks upon the rocks where they occur. A small compass and a piece of thread, the latter to be stretched along the furrow and over the centre of the compass, are the only things needed. Notes thus obtained, and recorded carefully and conscientiously upon the spot, are always valuable. In all cases the magnetic meridian should be used; and the correction for declination, according to the year and the location, applied afterwards: the use of two meridians in the field leads to confusion. The date, too, should always be affixed. It is well, also, to check the magnetic needle, for local disturbance, by taking the bearing to some known feature in the landscape when such exists; and where two points, the exact positions of which are known, can be seen, by taking the bearing of both of them, the place of the observer is easily determined; so that the point of his observation may be laid down upon the map. Glacial traces may be rubbed off from the stone itself, when it is somewhat smooth, in the same manner as children obtain the figure from a coin. Such impressions are often very satisfactory; being taken from Nature's own engraving. The meridian should be put upon the paper before it is moved from the stone in the above operation.

MUSHROOMS.*

BY JOHN L. RUSSELL.

A PLEASANT little treatise on some of the more prominent species, and one well adapted to afford just such information as those who are not strictly botanists might need.

Some faint idea of the immense number of these obscure but interesting plants may be obtained from the title-page of the Rev. M. J. Berkeley's "Outlines of British Fungology, containing the characters of above a thousand species, and a complete list of all that have been described as natives of the British Isles." (London, 1860.) Of these 1,000 are large and conspicuous, and 1,406 are smaller and even minute, of which the species of Sphæria alone which speck the leaves, and fruit of various plants in Great Britain, are 203 in number. In Fries' great work on the species of a single family, the Hymenomycetes, we find an enumeration and description of 2,545, embracing, for the most part, the larger kinds known to him in various regions of the globe. (*Epicrisis*. Upsaliæ, 1836–38.) In the year 1831, Lewis D. de Schweinitz communicated to the American Philosophical Society, Philadelphia, a list of 3,043 species of fungi which came under his observation around Bethlehem, Pennsylvania. The list has been greatly enlarged since by the labors of Curtis, Ravenel, and other botanists in the Southern States, and by the collections of various individuals at the North.

The singularly varying forms, under which many of the Fungi appear, have given rise to species which farther research has reduced to some previously described. Abroad, the researches of the Tulasnes are elucidating this branch of the subject, and exhibiting most interesting details, and new as well as novel fields of investigation await the Ameri-

* A Plain and Easy Account of the British Fungi, etc., etc. By M. C. Cooke. With twenty-four colored plates. 12mo, pp. 148. London, 1862.

can botanist who will reduce to practical results a series of observations requiring a lifetime to acquire.

In view of the extent of our subject, the treatise before us can be regarded as no more than a brief and meagre account of some of the few and more prominent species which might occur to a beginner in such districts of England as are fertile in species. But it is to be regretted that the American press is not as generous in contributions to knowledge in the various departments of natural history as is that of the mother country. Just such a cheap and prettily illustrated treatise, which should be strictly American, would do a great service, and would be what many young persons need. There seems no good reason why the fantastic and gorgeous creations of the fungi, which deck our woods and spring up around our dwellings, or are found in our pastures, should not be studied and as well known to the young, as are the blue flowers of the Hepatica, or the rosy corols of the May-flower, or the first Violets and the Saxifrage and Columbines, which annually awaken a vernal zeal for botany, but which faints and fades away on the coming heats of June, or the sultry days of August. Who has not admired the Agarics and Boleti and Clavarias in the pine woods in September, and who has not longed to know something more of them, to learn their names, their good or bad qualities, their uses or ends? The brilliant scarlet disk of a Peziza, starting into life from beneath the dead leaves of a Pennsylvania wood, takes me back now to the vicinity of Pittsburgh, where years ago I searched for the Erigenia, the first blossom of the spring there; and there is no autumn which does not thrill me with a new life as I see the shady paths and the wet spots of Cat Swamp so bravely adorned with these fugitive and fugacious forms of vegetation.

The excitement which spurs on many a student in natural history, that he may be the possible finder of a *new* species, is coincident with the study of the fungi. Spots most familiar to the eye, often are found producing kinds either

quite novel, or at least of occasional occurrence. Dependent as it would seem on some atmospherical conditions, species of fungi are meteoric, and visit places which seem quite singular and remarkable. Some extraordinary specimens of the exquisite Morel (*Morchella esculenta*) were found in the coal cinders in the rear of the Eastern Railroad depot. by the late Mr. Knights, a worthy employee there. Occasionally I have seen it in old orchards, but should scarcely have supposed it the product of cinders. The beautiful Cyclomyces was first discovered many years ago in Tewksbury, in this State, by Dr. B. D. Greene, and found to be entirely unknown before, though subsequently occurring elsewhere. I look for the possibility of the appearance of the truffle in some sections of the limestone strata of the United States; and other wonderful and beautiful sorts are only waiting to be found.

The value of the larger fungi as articles of food is scarcely known and hardly appreciated in this country. The table recognizes them chiefly in the presence of ketchup, made of species indiscriminately gathered by those who prefer this article or sauce. It is probable that a few only are really deleterious and poisonous, and even these are rendered comparatively innocuous by heat and spices. Otherwise than this they are rather objects of prejudice, and most persons look upon them with disgust. Even for their mere exterior beauty they are seldom sought, and still less are they employed for ornament, like their equally fugacious and soon-fading sisters, the many sorts of wild flowers which decorate the parlor. I have, however, seen them gathered and arranged for this purpose, and with singular effect; and the interest such groups, exhibited at the Horticultural Society Rooms in Boston, elicited was worthy of remark. The number of the Agarics described by Berkley in his "Outlines" is 564. as found in England, yet scarcely more than a single species, the *A. campestris*, is made an article of food. This species is represented in this country, and when cooked is

certainly a pleasant morsel. The Rev. Dr. M. A. Curtis, in his Catalogue of the Plants of the State of North Carolina (Geological Report), 1867, gives 438 species of Agarics, of which he considers fifty-six as esculent. In Poland and Russia even such abstemiousness is unknown, and most kinds of the larger fungi that occur are employed for food by the common people, either in a dried state, or after pickling in salt or vinegar. That there are highly poisonous qualities resident in several is indisputable, and is well known, as has been shown by Christison and others; one being an acrid matter so very fugacious that it disappears when the plant is dried or boiled or macerated in weak acids, alkalies, or alcohol; the other principle is more fixed, resisting the action of these tests, and resembling in its effects the operation of opium.

Many years ago, Greville, in a Memoir before the Wernerian Society of Edinburgh, directed the public attention to the use of the esculent fungi as a staple article of diet; and Schwaegrichen, the illustrious editor of Schweinitz's first contribution to the knowledge of our North American species, derived great satisfaction in eating those which possessed neither a bad flavor nor a disagreeable smell, and which had a tolerably firm consistence, with bread and drinking nothing but water; such a diet pursued for several weeks, as he affirms, increasing his strength and improving his health. "I have observed," says Persoon, who furnishes this account, "that fungi, if moderately used, are very nourishing." The experiments of Braconnot and Letellier detected a substance to which the name of *fungin* is applied, present equally in the harmless and poisonous fungi alike, which in itself is highly nutritious containing nitrogen, and very similar in its composition to animal matter. The process of cooking is therefore conducive to the gustatory condition, and advantageous in overcoming what is deleterious, if present in species considered esculent. A more general as well as accurate knowledge of our native species would place these despised

plants on the same level with other and higher forms, which embrace among our garden vegetables wild states of several equally poisonous and of many plants beside, often mistaken for harmless ones, ending, if used, in fatal results.

About eight years ago appeared the Rev. Dr. Badham's valuable work on the "Esculent Funguses of England," with drawings of the species colored after nature, and defining their localities, uses, and importance; indicating attention in the right direction to this subject, and followed shortly after by the little treatise whose title stands at the head of this article. To understand the arrangement and classification of the fungi requires a careful study of the systematic treatises of such botanists as have made them a specialty, and to give even an idea of such systems would be out of place here. Yet some peculiarities noticed by our author may not be wholly devoid of interest. "To say that fungi may be found everywhere, would not perhaps be literally true; but to say where they are *not* found under any circumstances would be puzzling,—every rotten stump or twig, every decaying leaf or fruit, has its peculiar species,—some large enough to attract immediate attention, others so small as to be invisible to the unaided eye." (p. 3.)

Of these latter may be mentioned, as confirmatory of this statement, the parasitic fungus, which destroys by a slow consumptive disease the life of the common House-fly (*Sporendonema musca*); and the *Botrytis bassiana*, which infests the silk-worm; the mother of beer and vinegar is the mycelium* of other species; and similar mycoderms* riot in the inkstand, and even in pharmaceutical preparations; the decaying hoofs and horns of animals, and the feathers of birds produce their particular kinds; the lungs of water-fowl are attacked by others; the skin of fishes, and the eggs of toads and frogs are destroyed by parasitic fungi. No substance escapes their visits, and even iron hardly cooled has been found invested in a few hours with fungoid threads. The

*Conditions of fungi in open or matted threads, from which mouldiness often springs.

minute organisms, which serve for seeds and known as spores, float in the air and lodge in the water, waiting opportunity to germinate and grow. Even the cavities of nuts, and the tough kernels of apples develop certain species; and roots and solid timber alike are rent asunder by the presence of particular kinds. The mildews which cover our gooseberries and hops, and the foliage of the vine, or the husk of the ripening grain, are forms of the smaller fungi, and all powerful in their littleness.

"Nor are these plants less worthy of notice on account of the rapidity of their growth. The great puff-ball springs up in a marvellous manner to the size of a pumpkin during the night, and Dr. Lindley has computed that the cells of which its structure is composed have multiplied at the extraordinary rate of sixty millions in a minute. Dr. Greville mentions an instance of one of the largest of British fungi (*Polyporus squamosus*) attaining a circumference of seven feet five inches, and weighing thirty-four pounds after having been cut four days. It was only four weeks attaining to these dimensions, thus acquiring an increase of growth equal to nineteen ounces per day." This rapidity of growth is only equalled by the amazing power which vegetables, so fragile and tender in their tissues, possess; instances being cited where pavements have been lifted by the growing of fungi beneath; but somewhat of the same phenomena may be yearly seen in the woods, where clusters of brittle fungi, by perpendicular pressure, lift masses of earth and leaves upwards as they issue into the air and light; and in the early spring the same phenomena may be seen where the flowers of the Christmas-rose penetrate the frozen ground.

"It is a curious fact in connection with the growth of these singular plants" (the fungi), "that while Phanerogams absorb carbonic acid from the atmosphere and respire oxygen, in this instance the order is reversed, and carbonic acid gas is given off. Fungi appear to flourish best in the absence of light, in dark cellars, under flag-stones, in hollow trees and

in like places, where no other form of plant could exist: while some are entirely subterranean. The *forms*, too, which these singular plants assume are extremely diversified; in some the form is that of a cup, in others of a goblet, a saucer, an ear, a bird's nest, a horn, a bunch of coral, a button, a rosette, a lump of jelly, or a piece of velvet. In color they are almost as variable as in shape, the rarest color being green. We have all shades of red, from light purple to deepest crimson; all tints of yellow from sulphurous to orange; all kinds of browns from palest ochre to deepest umber, and every graduation between pale gray and sooty black; blue and violet tints do not abound, but these, as well as a beautiful amethyst, occasionally occur. White and creamy traits are very common. Odors are manifestly agreeable or disagreeable to a considerable extent, according to the taste of the inhaler, but it must be confessed that some of the fungi exhale an odor so intolerably fetid, that no set of olfactory nerves could be found to endure it longer than was absolutely necessary; the truly elegant but rare *Clathrus* being an instance to the point. Fortunately this unpleasant feature is not common in the fungi, some smelling like new-made hay, like violets, like anise, or walnuts, or new meal, or tarragon,—and a variety of flavors which the fungi possess is calculated to please."

It has been asserted by some botanists that climate greatly modifies the properties of these plants, and renders them harmless, where found out of their native habitats. A magnificent species, known as the *Amanita muscarius*, or Fly Agaric, a native of Europe, and found in our woods, is one of twelve species occurring in England, of which many beside this one, are decidedly poisonous and used in the preparation of fly-paper. Roques, in his work on the esculent fungi, distinctly says, "That this plant has not its poisonous qualities modified by any climate, the Czar Alexis lost his life by eating of it, and yet it has been affirmed that in Kamtschatka *it is used as a frequent article of food*, and is

cooked and eaten in Russia. In Siberia, it supplies the inhabitants with the means of intoxication similar to that produced by the *haschisch* and *majoon* in the East."

Under the vague and general name of mushrooms, several species of fungi are consumed as articles of food. It may be true that in some localities, only one or two species are dignified with the appellation of mushroom, while all the rest which resemble it in form are condemned as toadstools: yet we believe there is in prospect an age when more of those which are really worthy will be admitted to the tables of rich and poor without that accompaniment of suspicion and dread which attaches to a dish of mushrooms. We accord perfect justice to *Agaricus compestris*, the mushroom of cultivation, whilst more delicious kinds, and equally harmless, are allowed to flourish and decay year by year without molestation.

Dr. Badham, whose work we have already mentioned, gives us instances of "beefsteaks growing on oaks in the shape of *Fistulina hepatica; Agaricus fusipes* to pickle in clusters under them; puff-balls, which some of our friends have not inaptly compared to sweetbread for the rich delicacy of their unassisted flavor. *Hydna*, as good as oysters, which they somewhat resemble in taste; *Agaricus deliciosus*, reminding us of tender lamb kidney; the beautiful Yellow Chanterille, the *Kalon kai agathon* of diet, growing by the bushel; the sweet nutty *Boletus* in vain calling itself *edulis* (edible), where there was none to believe; the dainty Orcilla (*Agaricus heterophyllus*), which tastes like the crawfish when grilled; the red and green species of *Agaricus*, to cook in any way, and equally good in all."

Of this list of dainties let us see what we have among us wherewith to replenish our larder. The beefsteak (*Fistulina*), though not given in my friend Sprague's second list of New England fungi, in the Proceedings of the Boston Society of Natural History, vol. vi, p. 315, is credited to D. Murray in a previous list of the fifth volume, p. 325; and

according to Schwinitz, is common throughout all Pennsylvania, and often of the greatest size. We must forego the pickled *Agaricus fusipes*, unless brought to light by Curtis or Ravenel; the creamy puff-balls, which in the *Lycoperdon giganteum*, is, according to our author, excellent eating, especially esteemed in Italy, and on the authority of Mrs. Hussey (author of a costly work on British Mycology) are, when sliced and "dipped in the yolk of egg, and sprinkled with chopped meat, herbs, and spices, much lighter and more digestible than egg omeletts:" these rare bits are represented in the *L. Bovista*, which attains an enormous size, and would furnish "omelets" for an army. Then for vegetable oysters we have several species of *Hydna:* the lamb's kidney in pine woods is the *Lactarius* (or Agaricus) *deliciosus* and the *volemum* is in Mr. Sprague's list, a more common species; as to the "beautiful yellow Chanterelle," which smells like ripe apricots, a bright sunny afternoon in September revealed such a group to my eyes as has gladdened them ever since when my memory has recalled the scene; the edible *Boletus*, if not among our native species, is curiously represented by some counterfeit, and, according to C. C. Frost, occurs in the woods of Brattleboro', Vermont; the dainty Orcella, I am sorry to say, is found in bad company with species of *Russula*, and no matter if wanting with us, a genus containing "some of the best and some of the worst of fungi viewed in an alimentary aspect, and some of the most brilliantly colored species."

Our author gives us quite a list of species not uncommon in England, some sold by the quantity in the markets with their true scientific names, without which they could not be recognized with any degree of certainty. In a few instances we have been able to identify them with American kinds, by comparing reliable catalogues of our own mycologists; but even this method is not without certain objections, since by the united labors of Berkeley and Curtis, the Schweinitzian collection has been found not so authentic as it could be

wished. The student, curious in these matters, may be referred to these papers in the Journal of the Academy of Natural Sciences of Philadelphia, for July, 1856 (new series), and to those in the Memoirs of several Scientific Societies, and to Dr. Curtis' list of plants alluded to above. But in an enterprise like the one before us, the efforts of gastronomy must be enlisted, and a series of experiments instituted upon our New England species. Plants thus low in the order of vegetation would be most likely to be represented by co-species and transatlantic forms, equally good for food or dangerous as viands, possessing the chemical principles which are to be sought and found in them.

The fairy-rings, described in English books, are due to the presence of a modest little Agaric, figured and colored to life, under the name of *Marasmius oreades*, an appellation which we find in Mr. Sprague's list, but with which we have no personal acquaintance. "The little fairy-ring Champignon," says M. C. Cooke, "is one of the privileged few that enjoy a good reputation, but even in this instance the reputation is local. In the dried state they are available for culinary purposes, while thousands of them annually rot in the pastures, where they grow without a hand to gather them. There is scarcely a more delicious fungus. It is so common in districts that bushels may be gathered in a day. They may also be readily dried by stringing them together on a thread, and suspending them in a dry kitchen, and when thoroughly dried may be kept in close tins."

Allusion has already been made to the *Boleti* as articles of food, of which both England and this country possess many species. In selecting them for trial in cookery, we are informed that "it will be advisable to caution all who are inexperienced in collecting Boleti, that several are unwholesome, some decidedly poisonous. If upon cutting or bruising any specimen it should be found to change color, it should be rejected. Some species become blue almost immediately upon wounding; those with reddish stems, or

with the under surfaces red or crimson, should also be rejected."

Any one familiar with our woods in the autumn must recall the numerous sorts of the coral fungi, so delicate and branched in variety of shapes, as to remind him of the corals of the ocean. They bear the generic name of *Clavariæ*, from *Clavus*, a club, the single branches being blunt or club-shaped at the apices. If such on being gathered and carried home are laid upon a piece of slate or black paper, a multitude of small white particles, or perhaps of a bluish-gray color, will fall from them, and become visible after a few hours. These are the *spores*. "All the white-spored Clavarias are wholesome; but some are so tough and leathery, and others are so small, that the number at all available for culinary purposes is limited. They should, after being collected, be washed in lukewarm water and perfectly dried, then tied together in little bundles like asparagus, and cooked with butter, parsley, onion, pepper, and salt; when cooked, they may be improved by the addition of a little cream and the yolk of an egg."

The English and European species cited are *C. C. cinerea, amesthystina*, *rugosa*, *vermiculata*, *fastigiata*, *coralloidea*, and *cristata*, of which we have several, and representatives of the others. The *Helvellas*, like the *Morels*, to which allusion has been made, are also classed among the edible kinds, and represented in our country in two more species at least. "The best substitute for the expensive Morels may be found in two indigenous species of *Helvella*, which, like the *Morels*, may be gathered during the season, and dried, and thus preserved for use all the year round. They impart an excellant flavor to gravies and soups." Related to these, but of different shape, size, color, and consistence, are the numerous *Pezizæ*, of which the list of North American exceeds at least two hundred species; and in Great Britain one hundred and thirty or more. They are interesting to the mycologist, presenting in their exterior both delicate and gorgeous tints,

varying much in size, and found almost everywhere in moist situations. "In the manufacture of the handsome Tunbridge ware, a variety of wood is employed under the name of green oak. Although of a mineral green color, this is the ordinary British oak; but the alteration which it has undergone is due to the presence of a fungus. A handsome little species resembling a *Pezizia* traverses with its mycelium the whole fabric of such wood, and these minute threads give the green tint to the timber." Similar tinted but decayed sticks and pieces of timber may be found in our own woods, owing doubtless to a similar cause.

In conclusion, it is to be hoped that the coming season may be seized upon for collecting, delineating, and coloring from living specimens some of the many fine and curious species of this vicinity; and that our naturalists may institute experiments, aided by the chemist and the gastronomer, in this line of wholesome, novel, and dainty tidbits of the table.

SPONGES.

BY A. HYATT.

Among the dark-brown leaves and green filaments which are borne upon the edge of the incoming tide, one frequently observes a substance hardly distinguishable from the surrounding plants, except for its light-brown color and porosity. This is sometimes dendritic,* with lank branches springing from broad, thick-spreading bases; but generally it is broken into fragments, and only the palm-like parts, with their finger-shaped ends, are left grasping among the froth-covered sea-weeds. A slight pressure will expel the water, and the aspect of the half-dried specimen will at once arrest attention.

It is in fact a Sponge, differing only in the details of its

* Branching like a tree.

structure and its general form from the sponges of commerce. The latter, whose irregular swelling outlines are so familiar to us, are of foreign origin, the better kinds coming from the more eastern shores of the Mediterranean, the coarser and larger kinds from the Bahamas. The commercial value of these is based upon the horny nature and closely interwoven texture of their internal skeleton.

A sponge is, typically, a gelatinous mass, in which is imbedded numerous little spikes and plates, of a horny, calcareous, or siliceous substance; or hair-like threads of various forms, which are so thickly disposed and closely knit together by animal matter, that they form a sort of open-work frame supporting the looser tissues.

In the common sponge this frame-work is wholly composed of horny hairs, which are so densely packed and elastic that they immediately resume their original shape after being compressed. The gelatinous matter is in all cases cleaned out after the sponge is torn up from its rocky bed, and those which we utilize are only the horny skeletons of the living animals. So loosely constructed and fragile, however, are the large branching species of our own coast, that a dried specimen may be crushed to powder in the hand.

The exterior of our beach specimens have a furry look, due to the projecting points of the spiculæ, which protrude through the outer skin. Scattered holes of considerable size reveal portions of the interior, and between them are innumerable smaller pores. These larger apertures connect with distinct channels which ramify through the mass in all directions, and, when surrounded by their native element, expel continuous jets of water. In fact the whole is only an apparatus for absorbing and ejecting sea-water, well deserving its old name of sea-lungs.

The surrounding liquid is taken in through the smaller pores of the outer side, and, passing through the lung-like interstices of the structure, is finally collected in the main channels and thrown out again, together with quantities of

feculent matter through the larger openings. The meshes of the sieve and the channels are thickly lined with myriads of microscopical animalculæ, to which the perpetual current bears their minute food, sifted of all the coarse, unsuitable particles, and maintains an invigorating supply of fresh sea-water throughout the whole colony. The animals themselves create this current by the motion of ciliæ, or little hairs, which grow out from the region of the mouth. The form of their bodies has been ascertained in only one species, called *Leucosolenia botryoides*. In this, which is quite small, though common on the shore, Professor H. J. Clark found that they were minute sac-shaped beings, with a collar projecting from the free end, in the middle of which was the mouth, situated at the base of a long filament which was hardly ever at rest. It seemed to be employed principally in casting morsels of food down into the mouth, and this action, in itself so slight, is yet, when carried on by the thousands of neighboring filaments, sufficient to keep the fluids in rapid motion through the meshes.

Until of late years the animal nature of the sponge was disputed. Then it was referred to the Amæba forms, creatures which are mere sprawling drops of jelly, without mouths or stomachs, but which, however, manage to move about, and even in some species build up most elaborate internal structures resembling minute shells. Now, through the investigations of Professor H. J. Clark, we know that they are colonies of such comparatively highly organized beings as those I have described, and we are also able to state, upon the same authority, that their young are free, roving globules, resembling an isolated individual of the parent stock.

The mode of growth has not been studied in the sponge itself, but in a closely allied animal where a number of little bells grow upon a stem (*Codosiga pulcherrima*). The young of this is free at first, but finally attaches itself, and becomes elevated on a pedicle. Then the vase grows more

oval, the opposite sides at the narrowest diameter approach each other, coalesce and split, dividing all the internal organs, and the mouth and calyx, or collar, into two parts. Two other filaments grow up from these halves, and a fissure begins in the disk, which gradually spreads both upward and downward, until two transparent vases, complete in structure, swing upon the trunk which bore only one an hour before. This process in some species is continued until quite a cloud of descendants cluster around the parent branch, but in others, again, only separate and distinct individuals are produced, the division totally separating the stem as well as the body.

The sponge, probably, grows in the same way; but the vases, having no stems, remain attached side by side, and secrete the gelatine and spiculæ, or horny hairs, from the lower surfaces of their bodies. These support the membrane and enable it to maintain a definite outline, and continue its growth without the danger of collapsing.

There are several species on our coast, but the most noticable is the great Halichondria, whose favorite resort is an old wharf-pile. This may not seem an attractive object, but Nature has clothed the whole coast with her living tapestries, and even here, her taste is as faultless, and her hand as lavish in decoration, as in more favored and sunnier spots.

Get into your boat, and when the tide is lowest float down under the wharves through which the current has a clean sweep. The waves lift the dank bladder-weeds and long green sea-hair which cover their stained sides, while below these, brown clusters of mussel-shells open their fringed mouths, and huge anemones, as thick as your arm, spread their laced crowns of white, brown, crimson, or variegated colors on the water-worn logs; and in the midst our great sea-lungs hangs out its mass of branches, and spreads its weird fingers up towards the observer. Even the sponge is beautiful in such places and with such associations.

NOTES ON TROPICAL FRUITS.

BY W. T. BRIGHAM.

[Continued from page 186.]

Cocos nucifera, Cocoanut. To attempt to give a bare enumeration of the qualities of this most useful of the noble family of Palms would be a difficult task, and there is a saying among Eastern nations that its attributes would fill a book. Although its strict territory is bounded by the tropics, and although a denizen of the sea-shore, it will grow as far north as Lucknow, in India (26° 50′ N.), and is planted far in the interior of that peninsula; but in the one case it does not bear fruit, in the other is dwarfed and languishes. From its littoral position, its buoyant and well-protected nuts have been driven by winds and currents all over the tropical seas, and almost as soon as the atoll changes from a mere reef to an island, the cocoanut lands on the shores.

The tall unbranching stem, often attaining the height of ninety-feet, with a diameter at the base of three feet, and at the crown a foot, is a most attractive object. The scars of the fallen leaf-stalks, more and more distinct as they approach the top, show clearly the way in which the stem has grown, starting almost at the commencement of life with its full diameter, and throwing off crop after crop of leaves as it grows in height. The leaves are usually twelve or fifteen in number, often fourteen feet long, and cluster around the cap. As a new leaf comes out, it is covered with a brown fibrous sheath, which is soon split through by the sharp end of the leaf. At first the leaflets are folded closely upon the central rib, so closely that they seem a part of the smooth, bright green blade. The midrib is now quite short, much like the midrib of our common palm-leaf fans, and if we could crumple one of these dried leaves up, we should have much the plan of the young cocoanut leaf. If the blades

should now expand the leaf would be palmate; but it goes on lengthening the axis and becomes pinnate, showing a higher order of development. Five or six leaves are unfolded every year, and as many wither and fall off. When young the leaves are quite tender, but when fully expanded, become very stiff and hard.

The axillary spathe opens always on the under side and soon falls off, leaving a spicate spadix bearing the female flowers near the base; as in most palms the blossom is beautiful from the great number of the flowers, rather than from any individual grace. In favorable places each stem will bear from five to fifteen nuts, and a mature tree may have eight or ten, or even twelve of these stems, one blossoming every four or five weeks; so that a tree will produce from eighty to a hundred nuts annually. They ripen in succession, so that blossoms and fruit are seen at once.

As the fruit comes to us its glory is gone. It is in its best condition just before ripeness, or when the shell is soft enough to be cut with a knife; then the interior is filled with a rich clear milk, always cool when just gathered, and the shell is coated with a gelatinous cream almost transparent, and so soft as to be eaten with a spoon. When fully ripe, the inner crust has hardened, and absorbed the better part of the milk, leaving an insipid water. The milk is quite nutritious, and many medicinal effects have been attributed to it. I have drank nothing else for several days, without perceiving any unfavorable result. It is perhaps with more reason regarded as a cure for sea-sickness. Carefully picked with a portion of the stem attached, they may be carried for three weeks at sea uninjured, perhaps longer, so that we might be supplied with fresh nuts from the West Indies.

A cocoanut is always planted with the three black spots, which are seen at one end, upwards. From one of these the stem rises, and the shell is soon split. Often the nut does not begin to germinate for six months, or even a year after

planting, and it grows slowly for the first two years of its life. In favorable situations the tree begins to bear when six years old, and continues until seventy years, or even longer.

It is said that the palm loves the company of man, and grows best near his habitation, and well may man return the love, for it furnishes him with all the necessaries, and many of the luxuries of life, requiring no cultivation or care. The wood is hard in old trees, and very ornamental, and is used for timber. The rootlets are eaten, or rather chewed as tobacco: the young leaves are boiled and eaten as cabbage; when they are older they furnish a good surface to write on with a sharp point (cow-dung is usually rubbed in to make the characters more visible), and also to thatch houses, fence gardens, make baskets, mat-beds, fish-nets, fans, sieves, and hats; when old and dry, the stout midrib is used for clubs, paddles, rafters, fence posts; the ribs of the leaflets for brushes, torches, or the whole is burned to furnish potash. The husk of the nut is stripped off by means of a small stake fixed in the ground, and a man can strip a thousand nuts per diem, and the husks are then soaked for several months in water to separate the fibre, and finally twisted into rope, or woven into mats under the name of coir. This rope is very strong and light, does not rot when wet, and floats on the water. Forty nuts usually yield six pounds of coir. The undressed fibre of the husk is a capital polishing material, and sailors use nuts split in halves to rub down decks.

Before the spathe opens it is often tapped, and a clear juice runs out which is fermented to form toddy, or boiled down to make jaggery, or palm sugar. This tapping is supposed to injure the tree if long continued.

The ripe nut is cooked and eaten in various ways. When grated it is an ingredient of the best curries; mixed with sweet potato, or kalo, and baked, it forms a fine pudding. The Pacific islanders chew up the meat and rub it into their

hair as a pomatum, and whether owing to this application or not, their hair is exceedingly abundant and black.

The oil is, perhaps, one of the most valuable products. The Micronesians break up the nuts, and expose the meat to the heat of the sun in covered troughs, wetting the mass constantly. Fermentation takes place and the oil drops out into containers. The East Indian process is almost as rude, the nuts being ground in a wooden or stone mill of primitive construction. The oil produced, of course, varies in quality as well as in quantity, ten nuts producing one quart, or in other cases thirty nuts only three pints. In other places the ground nuts are pressed, and sometimes boiled. The best oil is used either for cooking purposes, or to anoint the body either before or after bathing,—a most grateful process in a hot dry climate; and the poorer qualities supply the lamps. Torches are often made of elephant's dung bound into cylinders by the ribs of the leaflets, and saturated with the oil.

Borassus Sechellensis, the Double Cocoanut. This was long regarded as a most valuable medicinal charm,—a sure remedy for sterility either of man or beast; but its reputation has much diminished. It differs from the ordinary cocoanut in having two distinct lobes, connected at the upper end so as to form a continuous cavity. The milk and meat are not so good as the common nut, and more resemble the contents of the Palmyra nut, so common in India and elsewhere.

Phœnix dactylifera, Date. The leaves are shaped like those of the cocoanut, but are stiffer and of a lighter color. The lower portion of the stalk remains attached to the stem long after the leaf has withered, making it rough and admirably adapted for harboring small snakes, centipedes, or the more agreeable parasites of the vegetable world. The male blossoms are exceedingly numerous, eleven thousand having been counted on a single spadix, and yet to obtain a full crop of fruit artificial impregnation is necessary. The hard

woody spathe is not deciduous, and adds to the untrim appearance of the tree. In Egypt the fruit clusters are often of a hundred pounds weight, and hang down from stems as large as a man's wrist. The yellow dates are the smallest, and the black ones the largest in some places, but there is a variety of yellow dates three inches long. The cluster does not all ripen at once, but each date that matures is at once removed to make room for the rest. Dried, they form the chief food for the Arabs, and are much liked by all who are able to get them. The crushed and dirty dates that come to our markets are very inferior.

The date tree is not so long lived as the cocoanut, and its uses are by no means so extensive. The wood is soft, the blades of the leaves hard and narrow, and of course the coir and oil are wanting, and yet the fruit is perhaps the most delicious produced by any palm.

THE CYNTHIA SILK-WORM.

BY W. V. ANDREWS.

It is not at all a creditable circumstance to us, as an enterprising people, that so little has hitherto been done towards making silk-culture a source of national wealth. Thirty years ago, according to Mr. d'Homergues' account, some spasmodic efforts were made in this direction; but, for some cause, chiefly I imagine from the absence of skilled labor, the thing came to naught. In Connecticut, principally in the counties of Windham and Tolland, sewing-silk was manufactured to some extent; but even there the "hands" persisted in reeling the silk after the fashion of their grandmothers, and were far too knowing, and shrewd, to allow themselves to be taught anything by outsiders, who, probably under the cloak of a desire to communicate know-

ledge, harbored some base design on the pocket. What is being done in that locality now I do not know, and the only sewing-silk manufactory that I know of, is that of the "Singer Sewing Machine Company," in New Jersey. Of course all the silk they use is imported.

The silk-producing moth of the period above adverted to was, of course, the *Bombyx mori*, and the same species has continued up to a very recent period, to furnish most of the silk manufactured in Europe. With the conservative feeling which forms so admirable a trait in their character, the English have stuck to their old friend through good and evil report, till at last the disease which threatens to exterminate this once valuable insect, has compelled them, as well as their neighbors the French, to cast about for some more healthy silk-producer. Two species seem to recommend themselves, and they are the *Yama-mai*, and the *Cynthia;* the last-named being the favorite; and this is the moth whose culture here, as a silk-producer, it is the object of this paper to recommend. It has been asked, Why not select some native American species, and thus get rid of difficulties which will, doubtless, occur in the attempts to acclimatize this foreigner?

In the first volume of this Magazine, Mr. Trouvelot has shown, more or less satisfactorily, that our principal silk-worms, *Cecropia*, *Luna*, and *Promethea*, do not produce a cocoon suitable for the silk manufacturer. I must confess that I have my doubts of this. It seems to me, as the cocoon is made of silk, that, under favorable circumstances, it may be made serviceable; but I concede that, at present, we should turn our attention to other species. The *Polyphemus*, Mr. Trouvelot thinks, is the only American silk-worm worthy of present attention, and I agree with him. The silk produced by it is coarse and strong; and I am positive may be turned to profitable account. It possesses, too, I think, an advantage, in that the cocoon can be unwound with comparative ease.*

*For descriptions and figures of the *Telea Polyphemus*, see AMERICAN NATURALIST, Vol. I, pages 35, 85, 145, and plates 5 and 6.

But the principal objection to the American silk-moths is, that they produce only one brood a year, with the exception, I believe, of *Luna*. Now the *Cynthia* can be made to produce two broods easily; and, so far as I can see, the cocoon of the second brood is just as good as that of the first. Again, the food of some of the species is of very slow growth; such as the oak, the elm, and the hickory.

Now the food of the *Cynthia*, at least in this country, is the ailanthus, a tree of luxuriant foliage and rapid growth; and, at present, more ornamental than useful. If we acclimatize the *Cynthia*, we can reverse the order of things. It is somewhat doubtful, for reasons I shall presently give, whether the ailanthus is the natural food of this insect; but I will waive that consideration for the present.

In view of the confusion which evidently exists as to the identity of *Cynthia*, I think it best here to state, that the insect I am writing about is the one figured, tolerably well, in Duncan's Exotic Moths, Plate 14, fig. 1. The coloring there is not quite correct, but that is, doubtless, the moth.

Drury (Westwood's edition) has also given a tolerably accurate figure in his "Illustrations," and taking (as every body else seems to have taken) his description from that of Dr. Roxburgh's Memoirs on the Silk-producing Moths of the East (Transactions of the Linnæan Society, Vol. 7), calls it the "Arrindy Silk-worm;" says that it feeds on the castor-oil plant, and that its *soft* cocoons are so delicate and *flossy*, that it is impossible to wind them off, and that therefore they are spun like cotton. Now this description, which is substantially quoted by Mr. A. R. Grote in the "Practical Entomologist," by no means applies to the cocoon of the *Cynthia*. It is not a soft, flossy cocoon, like that of *Cecropia*, but hard like that of *Promethea*, which indeed it generally resembles. There is, to me, certainly a difficulty in winding it; and this, at present, is the main objection to it. But this difficulty arises from our ignorance of the proper solvents for the gum of the cocoon, and the proper temper-

ature at which to apply it. Pearlash is the best solvent I have yet found, but it is not, as I apply it, satisfactory. In fact a practical silk-reeler is required to decide this point. Mr. Grote, in quoting Kirby, who quotes Drury, expresses a doubt as to whether the *Cynthia* is really meant by the latter; and from all that I can learn the castor-oil feeder is certainly a different species.

Mr. Grote, in a subsequent paper in the "Practical Entomologist," says that the *Cynthia* is the *Yama-mai* of Japan, and that in that country it is an oak feeder; but surely this is a mistake of the Dutch author, from whom Mr. Grote transcribes. I have not reared *Yama-mai*, but I have some of its eggs, sent me by Dr. Wallace, of England, and they are nothing like the eggs of *Cynthia*. They are much larger and altogether of a different color.

To make confusion worse confounded, the very capital description of *Cynthia*, given by M. Tegetmeir in a recent English publication, is accompanied by a colored drawing of the insect, as much unlike that moth as the artist could conscientiously make it. So when we have the description right, the illustration is wrong; and *vice versa*, when the illustration is good, the description is bad. However, we have fixed on our moth. It is, as I said before, the *Saturnia Cynthia* of Duncan. Farther description I need not give, except to assure ladies who have so far got over their horror of "bugs" as to rear butterflies and moths, that they will find the extreme beauty, both of the *Cynthia* and of its caterpillar, a full recompense for any little trouble they may take in raising them.

I will now condense from a little entomological journal kept by me (I make no pretensions to being an entomologist), some remarks, having practical application to the subject before us; and which, I hope, may be of service to those who wish to assist in acclimatizing this beautiful moth, with a view to its ultimate culture as a silk-producer.

The eggs, which I obtained from Mr. John Akhurst, of

Brooklyn, were laid on or about the 18th of May, last year. From description, I had expected to find the eggs white, and without any central depression. I found them white, *streaked with black*, and the depression very obvious. The eggs commenced hatching out on the first of June, making about twelve days in the egg. The caterpillar is yellow, with transverse rows of black dots; head, black. On the 6th of June occurred the first moult, the yellow color brightening somewhat. On the 11th of June, the second moult, the color lighter, almost white. After the third moult the color is white, with black spots; the head and legs yellow. In fact, the body is covered with a very fine white powder. It has been objected to the *Bombyx mori* that it must be raised within shelter, seeing that exposure to heavy rains is injurious to it. Now *Cynthia* stands exposure to the wet admirably, as I had perfect satisfactory proof last year, the above-named white powder, as it is conjectured, standing it in good stead in a storm. Moreover, a certain amount of moisture is necessary for it. The caterpillar drinks greedily, and, in the event of indoor culture, I advise that the branches, when served fresh, should either be dipped in water, or sprinkled abundantly, particularly after the third moult.

I need hardly impress upon the mind of any one likely to read this paper, the absolute necessity of keeping the caterpillar well fed; but it may be as well to forewarn everybody that these creatures have excellent appetites, which "grow with what they feed upon." This is peculiarly observable towards the close of the caterpillar life, say after the last moult, when the craving seems to be insatiable. For those who have the opportunity of doing so, after the third moult, it is a good plan to place the caterpillars on low ailanthus trees in the open air. Of course they are liable to destruction here by birds, as well as by parasitic flies; but still, if you have a large quantity, and it is inconvenient to feed them under shelter, this plan may be adopted. Last year I

raised a great many in this way (this year I intend to increase the number), and as the caterpillar does not wander. I found no difficulty in collecting the cocoons. I allowed some to remain on the trees for the second brood, and had the satisfaction, in the fall, of seeing lots of cocoons swinging in their leafy cradles. And now is the time to speak of the ailanthus as not being the natural food of *Cynthia*. It feeds, we are told, on the castor-oil plant, laburnum, teazle, plum, honey-suckle, and spindle-tree. This sounds very much like saying that it will eat anything; but so far as my experience goes it thrives better on the ailanthus than on anything else; but the reason that I think that tree is not it natural food, is this: the caterpillar forms its cocoon very much in the manner of *Promethea;* that is, by folding a leaf around it, having first gummed the leaf-stalk to its branch, so as to prevent, one would suppose, its falling to the ground in winter. But the leaf of the ailanthus is what botanists call a compound leaf; so the unfortunate caterpillar, not being sufficiently versed in botany to know this, merely gums the *leaflets* to the petiole; the leaf of course falls in the autumn, and the pupa, instead of lying high and dry as was intended, lies under the snow all the winter; with what consequences to itself I am not able at the moment to say. It would appear, therefore, reasoning from analogy, that the tree forming the natural food of *Cynthia has a simple and not a compound leaf*. It may be of consequence to note this, for the quantity and quality of the silk produced by any worm very much depend on the food it eats, and the natural food must be the best.

I will now proceed with my extracts from the journal. On the 28th of June, just twenty-eight days from the hatching, the caterpillars commenced forming their cocoons; and here let me say to those who propose to raise them in the house, that at this period it is essential that there shall be a good supply of well-leaved branches. Every caterpillar will require a leaf to itself, and if these be not forthcoming the

cocoons will be doubled, and even trebled, to the great injury of the silk, it being impossible to wind the silk off a double cocoon. On the 21st of July the moth appeared; three weeks in the cocoon; and by the 6th of August the second brood of caterpillars began to hatch out; these going into the pupa state about the middle of September, and remaining there up to June 10th, I having kept them back a little on account of the backwardness of the spring. "On that date the first *Cynthia* from my collection of cocoons made its appearance, and there is every prospect that a few days more will witness an increase in that portion of my insect family."

I have now said enough to show that the rearing of this moth is a very easy, simple process, one which may be attended to by any boy or girl of ordinary intelligence, superintended of course, if the number raised be very large, by some older person. In a word, it furnishes profitable employment for those members of the family unable to perform harder labor. And this reminds me that if the feeding be done within doors, the food branches, or, at the outset, simply the leaves, should have their stems immersed in a vessel of water; some precaution being taken to prevent the young caterpillars from wading into, or falling into it. When nearly full-grown the clusters of fine caterpillars, set off by the rich green of the ailanthus leaf, form a very beautiful sight; and although I cannot conscientiously recommend such an ornament for the drawing-room table, it certainly may be placed almost anywhere without being offensive to the most fastidious eye. Plenty of air and light should be given them, but they should not be exposed to the direct rays of the sun. Reared, even from motives of curiosity, and without a view to immediate pecuniary results, the task cannot be performed without teaching a lesson, which will be of infinite value to the mind anxious to inform itself of the wonderful workings of that law of nature, that transforms a small crawling animal, of an eighth of an inch in

length when hatched from the egg, into a beautiful flying creature large enough to be mistaken for a bird, and with no more resemblance to the aforesaid animal than an eagle has to a frog.

But now a final word as to the steps to be taken to induce our people to take up this business of silk-culture. Can it be made to pay? is, I suppose, the main question. I need go into no statistics to show that enormous sums of money are sent to Europe every year to pay for silk imported; the fact is notorious. Perhaps no nation in the world is so addicted to the use of silken goods as the American. The general government collects large sums of money in the shape of duties on silk, and we can hardly, at the moment, expect that it will do much to encourage its culture here. But I am confident that it can be made to pay without government assistance. For, recollect, that we have the food of the caterpillar growing already in the greatest abundance among us, flourishing with a luxuriance which we sometimes find inconvenient; and of such easy culture that in two years we could have millions of bushes (and they should be kept as bushes) growing; and on soil, too, that would probably produce nothing else. This is an advantage that the early silk-growers did not possess, the raising of the mulberry being no such easy matter. Then the larva of the *Cynthia* can, as I have said, be raised in open air, and the labor of the young, or of the feeble, is sufficient to perform all the work required; and thus the objection of the "high price of labor," so fatal to many an American enterprise, fails in this case. Even children may be induced to raise a few bushels of cocoons for the sake of pocket-money. Still there is no use in raising cocoons if there are no manufacturers to purchase them. It seems difficult to account for the inertness of our capitalists in affairs of this kind. One would suppose that with men possessed of wealth, the reputation of having been instrumental in introducing a new source of national industry, would be sufficient to induce

some few at least to bestir themselves in so important a matter. But failing this, what objection is there to the *State Government* affording a little assistance in starting an enterprise promising to be of such great benefit to the people? I look upon an enterprise of this kind as of the nature of building a railroad, or constructing a telegraph line, the benefits to be derived from which, being of a public nature, come very properly under the immediate supervision of the government. It would be out of place in this journal to go minutely into such things as the duties of governments in fostering national industry, but I may be permitted to say, that, although disapproving of the principle of protective tariffs, I see nothing conflicting with my convictions on this point in saying, that, if the timidity of individual capitalists can be overcome in no other way, the State Governments would be justified in making advances, or in offering bounties, sufficient in amount to guarantee parties embarking in the enterprise of silk manufacture against any actual temporary loss.

In England, as I am told, private enterprise is doing all this. Wealthy individuals are largely cultivating the ailanthus for the *Cynthia*, and are encouraging parties in rearing the *Yama-mai*, and other silk-producers; and why should not as much enterprise and patriotism be found here? To be sure, entomologists are not there laughed at for being "bug-hunters;" and there are numbers of ready hands willing and anxious to assist in the undertaking; but I am not without hope that sufficient intelligence will be found amongst ourselves to enable people to understand that a devotion to the study of Nature's laws, even in the insect world, is not incompatible with the possession of, at least, average common sense.

Let it not be forgotten that the rearing of the *Cynthia*, as a silk-producer, is not a new, untried experiment. The Chinese, for a longer period than I should like to mention, have manufactured silk from its cocoons; the garments made from it possessing a durability quite annoying to ladies of the

Flora M'Flimsy type. Dresses made up for ladies in the early dawn of womanhood do very well for their grandchildren arrived at a suitable age; and, if this be not a recommendation, let us hope that the fact that some English manufacturers have given the opinion that the silk from the *Cynthia* may be made into shawls equal *to the best India*, may somewhat reconcile our fair countrywomen to the use of an old article possessing the preposterous quality of being as good as new, if washed in a little cold water.

REVIEWS.

THE NORTH AMERICAN GRAPES. *By Dr. George Engelmann.*—Perhaps the first plant noticed on the continent of North America, even before Columbus and before the Pilgrims,—a plant identified with the discovery of America itself,—was the Grape-vine; it gave to the country the name *Vineland*, and later, to a part of it, that of *Martha's Vineyard*. And yet the grape-vines, many forms of which grow from Canada to the Rio Grande, and from Virginia to California, are among the least thoroughly known plants of North America. Linnæus knew two species; and that sagacious observer, the founder of the flora of North America, Michaux, added three more. These five species are acknowledged to this day as the principal forms found in the regions between the Atlantic and the Mississippi. But even in their native haunts they vary to such a degree that both scientific and non-scientific observers have never felt satisfied about them. Rafinesque, about fifty years ago, undertook to describe and classify these forms; but, with his loose observation and lax scientific conscience, he, as usual, instead of becoming a guide, created inextricable confusion. Le Conte, long after him, did little to unravel the entanglement; and since their efforts to distinguish imaginary species, the tendency has rather been to combine what were formerly considered, even by conscientious authors, as distinct species.

I have long devoted much attention to the grape-vines of my home (St. Louis), but have become satisfied that no satisfactory solution can be obtained without the coöperation of the friends of botany throughout the whole country; so I ask from their love and zeal for our science, and from the general interest which this particular investigation now commands, their friendly coöperation.

In order to arrive at satisfactory conclusions, it is necessary to study all the forms which present themselves, in all their bearings, and under

the different conditions in which they are found. Specimens ought to be collected in flower, exhibiting also the young shoots and developing leaves, and, *from the same stock*, in fruit, if fruit they bear; and ripe seed should be obtained; the soil, the locality, the accompanying plants, and the size of the vine ought to be noted, the difference in shape and size of the leaves of young shoots and of bearing branches is often important; the exact time of flowering, and the period of maturity are interesting data; the size, color, and taste of the fruit, the presence or absence of the bloom on the ripe berry; the usual number of seeds in each, the conditions and color of the pulp,—all are points not to be neglected. It is not expected that species can be founded on the variations in all these characters, but it is important that the limits of variation of the different species should be defined; and that can only be done by exact study of as many forms as possible in all their bearings. Thus far I have only seen vines with perfect and with staminate flowers; purely pistillate ones may perhaps be discovered by acute observers.

The species now known to botanists in the territory of the United States, but several of them not sufficiently defined, are the following:

1. *Grape-vines with large Berries.*

1. VITIS VULPINA Linn., the *Southern Fox-grape*, or *Muscadine*, with several cultivated varieties, such as the *Scuppernong*, etc.

2. VITIS LABRUSCA Linn., the *North-eastern Fox-grape*, with numerous cultivated varieties, such as the *Catawba*, *Isabella*, *Concord*, *Hartford Prolific*, etc.

3. VITIS CANDICANS Engelm., the *Mustang grape* of Texas.

2. *Grape-vines with smaller Berries.*

4. VITIS CARIBÆA DC., of Southern Florida and the West Indies.

5. VITIS CALIFORNICA Benth., confined to California.

6. VITIS ÆSTIVALIS Michx., the *Summer grape* of the Middle and the Southern States, with numerous varieties, of which var. *monticola* (*V. monticola* Buckley) of Texas approaches No. 5, and var. *canescens* of the Mississippi Valley approaches No. 7; several cultivated varieties, such as *Norton's Virginia Seedling*, and the *Cynthiana* grape, are among our best wine-grapes.

7. VITIS CORDIFOLIA Michx., the sour *Winter* or *Chicken-grape* of the Eastern States, and its variety *fœtida* of the Mississippi Valley, often 4–6 inches in diameter, climbing the highest trees, and bearing fetidly aromatic berries. No variety I believe in cultivation.

8. VITIS RIPARIA Michx., the *River-bank grape*, throughout the United States to the Mississippi; the only grape in East Canada, where it extends sixty miles north of Quebec (Brunet); a valuable grape in cultivation, under the name of *Clinton*, *Taylor*, and *Delaware* grapes. An early native variety ripens its sweet berries early in July about St. Louis.

9. VITIS ARIZONICA, n. sp., and as yet doubtful plant, of Arizona, with small leaves, and middle-sized berries.

10. Vitis rupestris Scheele, the *Bush-grape* or (in Missouri) *Sand-grape*, which extends from Missouri to Texas.

It is worth noting that all those of the forms enumerated above, which I had an opportunity of raising from seed, exhibit marked differences already in the seedling plant a few months old. During my absence in Europe for the next twelve months, Professor A. Gray, of Cambridge, has kindly offered his assistance in communicating with those who wish to assist me, and letters directed to me, at St. Louis, Missouri, will be forwarded to me.—I. G. E.

The Corals and Starfishes of Brazil.*—But little is known of the shores of Brazil, and until their discovery by Professor Hartt, so graphically related by him in the Naturalist, was it ever known that there were reefs of coral on that coast. Professor Verrill here gives us in a connected form a view of the radiate animals of Brazil, with notes on those of Lower California. He remarks that

"It appears somewhat remarkable that while the Echinoderms, with few exceptions, are common West Indian or Florida species, the corals are nearly all, so far as known, peculiar to the coast of Brazil. This is, however, in accordance with similar facts observed in the Pacific and Indian Ocean, where the greater part of the tropical Echinoderms have a vast range, in some cases even from the Hawaiian Islands to the coast of Africa, while the corals are much more local, all the principal groups of islands having many peculiar forms. This is, perhaps, due to the much longer time during which the young of most Echinoderms remain in the free-swimming condition, liable to be carried great distances by currents."

The Book of Evergreens. By *Josiah Hoopes.*—The author has furnished, under the above modest title, a book than which none could be more needed. Good books are always in demand, and therefore the first paragraph of the preface might have been omitted, or at least so modified as to be a statement of the author's *claims* to teach concerning the Coniferæ, rather than an *excuse* for "intruding his views and experiences upon the public."

Mr. Hoopes has long been favorably known as a successful arboriculturist, and as especially successful in growing the Coniferæ. He has, moreover, been a pupil of the late, lamented Dr. Darlington, to whose memory the volume is dedicated. With these guarantees as to his competency, and with the superadded one of enthusiasm in his "specialité" we might reasonably expect something good. The reading proved our expectations to be well founded.

Up to this time no popular work on the subject, and suited to our climate, has been accessible to the American public. We should be unjust to the author, as he is to himself, if we limited its merit to merely supplying a popular want. It is more: for on its pages we find much that is valuable to the man of science, along with some smaller matters, which are open to his criticism. The views of classification expressed may or may not accord with those of Parlatore and Engelmann. Yet all the con-

* Notice of the Corals and Echinoderms collected by Professor C. F. Hartt, at the Abrolhos Reefs, Province of Bahia, Brazil, 1867. 8vo, pp. 20. Notice of a Collection of Echinoderms, etc., from La Paz, Lower California, with Descriptions of a New Genus. By A. E. Verrill. 8vo, pp. 6. April, 1868. With a plate. (From the Transactions of the Connecticut Academy of Arts and Sciences.)

clusions seem to be based on careful study. In these days of specific doubts and difficulties, it is all important, we think, that the broader views of species be taken. We would have even gone farther than Mr. Hoopes in our reduction of some hitherto accredited species, and we fancy we could, in a few cases, arrange them better under the genera. The goodly number of varieties enumerated shows he has not fallen into the bad habit of giving a new specific name to every sport produced under cultivation. The advice concerning the growth and propagation of Conifers may be considered as authoritative for the Middle United States.

We could wish that more space had been given to the "Insects injurious to Coniferæ." The analytical key is clear, and really smoothes the road to the determination of any given species described in the work.

Truth is truth, Mr. Hoopes thinks; and does not need any compromise to make it truer. Such is the spirit in which he claims the acceptance of *Sequoia gigantea* as the proper name for our California giant. The taste which would fill our grounds with imported trees, to the utter exclusion of our native beauties, is, we think, justly censured.

Judd & Co., of New York, have published the book in their best style. It should be in the library of every arboriculturist (whether amateur or professional) in the land.—J. T. R.

THE BUTTERFLIES OF NORTH AMERICA.*—Such a beautifully printed and finely illustrated work on our Butterflies, as this promises to be, will be opportune to all butterfly hunters as well as entomologists generally. Mr. Edwards brings to this work a thorough knowledge of our Butterflies, and the reader will find much that is new regarding their haunts and habits. In the early numbers the species figured will be mostly new, or if old, those that have been incorrectly described or figured. With Part III. will be commenced a synopsis of North American species, to be completed within the volume. The lithographic plates are beautifully drawn, and the letter-press is all that can be desired. When completed the work will make a most attractive volume. A number, containing at least five plates, will be issued every three months. Figures of both surfaces of the insect are given, and of both sexes wherever possible.

NATURAL HISTORY MISCELLANY.

BOTANY.

CHOICE NEW VARIETY OF KALMIA LATIFOLIA.—Flowers have just been brought to us by Mr. Charles J. Power, florist, South Framingham, Mass.,

*The Butterflies of North America; with colored Drawings and Descriptions. By Wm. H. Edwards, Philadelphia. Published by the American Entomological Society. Part I, 4to. April, 1868. Price of each part, $2.00. Subscribers may address E. T. Cresson, 518 South 13th street, Philadelphia, Pa.

of much the most marked and showy variety of the above species which I ever saw, and which, being in cultivation, requires a name. It may as well be named *Var. coronata*, the Crowned Mountain Laurel. The corolla is white, except a broad crown of dark crimson, continuous, but somewhat blotchy, which occupies the whole inside of the cup from the pouches up to near the margin, which again is clear white. A single shrub of this was accidentally discovered two years ago, in bloom in a wood near Framingham, by Mr. James Parker, but was destroyed by fire, the ground having been accidentally burned over. But a branch, given to Mr. Power, was preserved by grafting upon the ordinary form of the species. From this graft, which has now blossomed, it is hoped that this beautiful variety may be abundantly propagated. — A. GRAY.

A WHITE CHOKE-CHERRY.—There is a variety of Choke-cherry (*Prunus Virginiana*) bearing white fruit occasionally found about here. Is it found in other places?—D. W. C. CHALLIS.

ZOÖLOGY.

SHORE-COLLECTING ABOUT NEW YORK.—Thinking that some of your New England readers, who are of course lovers of Natural History, would be likely to pay a visit to New York, and would be glad to know where and how to pursue their favorite study, I have been induced to send you a few remarks on the subject. It is scarcely necessary to inform them that New York, like nearly all great commercial centres, is a very poor place to collect specimens in their natural situations, especially marine animals and plants, as the shore is so much in demand for wharves, docks, factories, etc.; and this explains why it is so difficult to procure specimens of shells, corals, etc. from sailors, who only visit large cities, and of course who have neither time nor inclination to walk a great distance in search of them, nor much money to purchase them.

Suppose a stranger in New York who would like to collect shells, Algæ, or zoöphytes; there are boats running up the Long Island Sound every day in the summer, and the ferries to Staten Island, but I would advise him to leave the city by the Fulton Ferry to Brooklyn, step into a Greenwood car, and tell the conductor he wishes to go to Fort Hamilton: when he reaches there, walk a short distance to the left past the fort, and his field is before him. One thing he should do before starting is to look in the newspapers and see what hour it is high tide that day, and choose his time as near six hours from that as possible, and so time his visit as to have as much beach as possible, for it would be almost useless to go at high-water. He will immediately notice that the geological formation is somewhat different to what it is on many of the New England shores, being all of the drift formation,—no rocks in place,—all loose boulders, sand, and gravel, so of course there are none of those beautiful natural aquaria full of actinias, algæ, and mollusks in a state of nature; but he may find many shallow pools where many very interesting objects may

be obtained. Of course, the shores have their different seasons, as the land has; for in the month of February the shore is covered with blocks of ice, so that nothing can be obtained; but sometimes in this month and the beginning of March, I have collected some of my handsomest sea-weeds; and we generally find in the coldest months the long fronds of *Laminaria saccharina*, nearly twenty feet long, which are never seen here in the warmer season. It is interesting and worth noticing that the largest marine plants, unlike the terrestrial vegetation, are generally found in the colder parts of the world. We read that our Northwest Territory, Alaska, is famous for producing immense specimens of Algæ, as for instance the *Nereocystis Lutkeana* which forms dense forests about Sitka; its stem is often three hundred feet long, and ends in a large air-vessel six or seven feet long, crowned with a bunch of dichotomous leaves, each thirty or forty feet in length. Cape Horn and the Cape of Good Hope also produce immense species of submarine vegetation, in comparison with which ours dwarf into insignificance.

But let the naturalist pay a visit to our shores in July or August, and he will find the waters red with beautiful specimens of *Grinnellia*, *Ceramium*, and *Callithamnion*, and a little later in the season the most beautiful plant we have, *Dasya elegans*, in great variety. This plant is also found in the Mediterranean. Many of our plants are found in Great Britain and Ireland, while some are peculiar to this country.

But let us stroll along the beach, leaving the Algæ, and see what shells can be found. *Nassa obsoleta* is the most common; this with *Nassa trivittata*, *Fusus cinerius*, *Natica duplicata*, *Crepidula fornicata*, and two species of *Litorina* comprise nearly all the univalves. We occasionally find dead shells of *Ranella caudata*, *Pyrula canaliculata*, *P. carica*, and a few of the smaller genera, such as *Odostomia* and a small *Cerithium*.

The bivalves mostly consist of *Mytilus edulis*, *Mya arenaria*, *Venus mercenaria*, *Sanguinolaria fusca*, and occasionally, though rarely, *Donax fossor*, *Pandora trilineata*, and *Osteodesma hyalina*. There are a few others found here, but so rarely, that a person might visit the beach a dozen times without seeing them. In the salt meadows, about half a mile from the fort, may be found quantities of *Melampus bidentatus*, and rarely *M. denticula*; here, after crossing a small brook, may be observed at low tide a beautiful proof of the subsidence of the coast of Long Island, for here we find beds of peat, and stumps of trees with their roots spreading in their natural position, showing very plainly, and beyond dispute, that the coast has settled very lately, geologically speaking.

The radiated animals are singularly scarce on this part of the coast. It is very rare indeed that a single specimen can be found of either star-fish, Echinus, or Holothuria; I mean in New York, that is from Coney Island to the city. When we get into Long Island Sound, to the east of the city, we sometimes find a few, though they are not plentiful for many miles off.

It may not be generally known, but I have been assured by ornithologists, that Long Island has produced more species of birds than any other

place in the United States of its size. Entomologists and botanists make the same statement in regard to their respective specialities. The shores from here to the extreme eastern end of the island are mostly protected from the ocean by sand-bars and islands, leaving large bays and salt-meadows, which are the favorite haunts of thousands of aquatic and rapacious birds. Many birds have been shot here this winter that are generally considered as very rare, such as the Labrador duck, the Harlequin duck, the Goss-hawk, and a few others not often seen. On the shores of Coney Island we sometimes find, about the months of February and March, immense quantities of *Mactra solidissima* and *Natica heros*. Last March the beach was covered for miles with these shells, especially the former, which was heaped up in beds two or three feet thick.—A. R. Y., *Brooklyn*.

The Crow Blackbird a Robber.—Three years ago this spring there came into our village a flock of a dozen or more of the common Crow Blackbird (which are plenty in the country above here) for the purpose of building their nests in the tall Lombardy poplars in our streets, and they have been with us each season since, leaving whenever the young can fly. Until this season they have made their nests only in the poplars, selecting places near the trunk, where the clusters of nearly upright limbs secure them from ordinary observation. This spring they have appeared in greater numbers; two pairs have built their nests inside the spire of a church, passing through the openings of an ornamented window high up above the tops of our tallest trees. A bell is in the tower of the steeple below, and is rung at customary times, and a colony of doves is in the section near the bell. The writer has just discovered that the Blackbirds have taken possession of a martin-house in his garden. They are busily engaged carrying in materials for nests, and the martins are flying helplessly about. Also, in the top of the pyramidal trellis covered with vines forming the lower half of the support of the martin-house, a pair are building. It is a place used some years by robins, but the fact was so novel, that instead of driving them off, a new martin-house is to be put up at once, near by, which the martins, in their necessity, will no doubt occupy. The Blackbirds are tame about our streets and gardens, lighting on the ground at the same time with the robins, with much the same habits in this respect, although evidently going beyond the limits of the village for most of their food.

We have robins in large numbers,—small birds being protected by law,—and on the arrival of the blackbirds the *first* season there was trouble among them, and their note, denoting disturbance, could be heard on every side, and for good reason, for the blackbirds, without so much as saying "by your leave," took the materials from every unfinished or unoccupied robin's nest they could find. But, singularly enough, the blackbirds soon succumbed, and the robins drove them away in all cases of contest; but they seem to live in harmony, and, as I have mentioned, are often in company on the ground seeking for food.—F. W., *Newark, N. Y.*

NOTES ON THE RED AND MOTTLED OWLS.—In a note to the very interesting paper of Mr. C. J. Maynard, on *The Mottled Owl in Confinement*, in the April number of the NATURALIST, Mr. E. A. Samuels alludes to the question as to whether we have two species of *Scops*, or whether the young of *S. asio* are sometimes gray in color and sometimes red, as remaining still undecided. As there is hardly a more interesting or more singular problem in the history of our birds, a brief history of the question, and a short recapitulation of the knowledge we possess on the subject may not be uninteresting.

The Red Owl was described by Linnæus, in the *Systema Naturæ*, vol. 1, p. 132, in 1766, under the name *Strix asio*. Gmelin, twenty-two years later, described (*Systema Naturæ*, vol. 1, p. 289) the Mottled Owl as *Strix nævia*. In 1812, Alexander Wilson, in the fifth volume of his admirable, and in many respects yet unsurpassed *American Ornithology*, redescribes the two, under the same names, also as distinct species; and not till 1828 does it appear to have been publicly hinted that the two were really one, when Prince C. L. Bonaparte united them, he considering the red birds as the young, and the gray the old. Audubon, in 1832, sustains this view; one of the red birds he figures as the young, being one he reared from a fledgling, and adds that long before Bonaparte corrected the mistake he (Audubon) attributes solely to Wilson, he, as well as some of his friends, was well aware of their identity. Nuttall, a few years later, supports the same view. In 1837, Dr. S. Cabot, jr.,* of Boston, while considering the two birds identical in species, reverses the order, making the red plumage the old, and the gray the young; and in confirmation of his views exhibited, as seemingly conclusive evidence, an old red bird he shot while in the act of feeding some gray young ones, which he also exhibited. In July of the same year Dr. Ezra Michiner, in a paper in the Journal of the Philadelphia Academy of Sciences (vol. 7, p. 53), entitled *A few Facts in Relation to the Identity of the Red and Mottled Owls*, states that he had seen young Screech Owls, accompanied by their parents after leaving the nest, of both red and gray colors, the parents being always of the same color as the young. "The conclusion is, therefore," he says, "evident, either that the color of both old and young is variable and uncertain, or that they are specifically distinct." The latter opinion he adopts, ignoring the then sole known case of different colors in the young and parent in Dr. Cabot's birds, very positively concluding there are *two* species, and that Wilson was right.

Dr. P. R. Hoy, in his valuable *Notes of the Birds of Wisconsin*, published in 1853 in the Proceedings (vol. 6) of the Philadelphia Academy of Natural Science, gives them as two species, remarking he is "not yet satisfied that the Mottled and Red Owls are specifically the same." He says, under *Scops asio*, "In the month of June I caught four young ones just as they were about leaving the nest. They were of a deep reddish-brown, in all respects similar to the female which I shot at the same time, and have

*Journal of the Boston Society of Natural History, Vol. II, p. 126.

preserved." Mr. John Cassin, in his various papers on the owls, adopts the conclusions of Bonaparte, considering them as one species, and the gray as the adult. He adds, however, referring to the fact of the two stages of plumage having been considered as characterizing two species, that "they do present a problem scarcely to be considered as fully solved." But the opinion that the Mottled and Red Owls are really but one species, is the one now generally adopted by ornithologists.

From the information now at our command on this subject, can we not fully solve the problem? The facts recorded teach us that nestlings and young fledglings occur in both red and gray plumage, in some cases birds of one brood presenting both conditions; that old birds are sometimes gray and sometimes red, both colors being common to both sexes, and that occasionally red males pair with gray females, and the reverse; that the young are sometimes like their parents and sometimes unlike them. These facts hence seem to warrant the following conclusions: first, that these different conditions of plumage do *not* characterize *age*; second, that they are not *sexual peculiarities*; third, that they are unusual and irregular variations of plumage of one species. Though such variations are extremely rare, our bird is in this respect not without its parallels in other countries. The best known instance seems to be that of the Brown Owl of Europe (*Syrnium aluco*), which, according to authors, presents similar variations. And they apparently occur in other species of *Scops*.

Considering, then, the Red and Mottled Owls as unquestionably one species, and one diffused widely over the continent, occurring from ocean to ocean, and from Mexico nearly or quite to the arctic regions, have we really a second species of *Scops* in the United States? In 1854, Mr. Cassin, in his *Illustrations of the Birds of California, Texas*, etc., describes a species of *Scops* from California, Texas, and Mexico, "in form and general characters much resembling *Scops asio*, but smaller," but which he considers new, giving it the name of *Scops Maccallii* (Western Mottled Owl). Its validity as a species distinct from *S. asio* has been questioned by very high authorities, and apparently with very good reasons, its chief and almost only distinction from *S. asio* of the north being its somewhat smaller size. Mr. P. L. Sclater, one of the highest authorities on American birds, in remarks (Proceedings of the Zoölogical Society of London, 1857) on a collection of birds from about Oxaca, in Southern Mexico, mentions an owl under this name, which, though he says it, "certainly has the appearance of *Scops asio*, and is smaller," but does not, he thinks, "quite fit" this species (*S. Maccallii*). Dr. J. G. Cooper, who has collected specimens of the bird in question in Southern Arizona, thinks it scarcely distinct from *Scops asio*. The slight differences in color pointed out by Mr. Cassin are of but little account, while the character of smaller size is either of no, or of negative, value. It is well known now to naturalists who have been at all attentive to the subject, that a diminution in size among birds in species resident over a large area is a constant attendant on decrease of latitudes, so that birds residing at points a thousand miles dis-

tant in latitude are likely to differ markedly in size, while presenting no appreciable differences in other characters. The few cases where this does not apparently occur, are only the exceptions to a general law. Hence we should expect to find the specimens of *Scops asio* collected in Florida, Texas, Mexico, and other southern points, smaller than those of the Northern States and Canada. Before this law was fully recognized—and which the immense collections of birds from widely different parts of this continent, recently brought together at the Smithsonian Institute, under the careful scrutiny of Professor Baird and his co-laborators, have aided immensely to demonstrate—many species were indicated whose chief and not unfrequently only distinction from more northern allies was the character of smaller size, and in this category seems to me to be the true place of *Scops Maccallii* Cass.; leaving then but one *Scops*—our well-known Screech Owl—to America north of the tropics.—J. A. Allen.

A Perching Snipe.—Mr. W. A. Pope has observed the *Scolopax Wilsonii* in Prince Edwards Island, "setting on the top of a tree at least thirty feet from the ground."—*Land and Water*.

Have our ornithologists observed this peculiarity in the snipe?

The Distribution of our Birds in the Breeding Season.—Professor Agassiz has issued a circular, in which he asks for the coöperation of ornithologists in securing specimens of birds and complete local lists, with full notes in reference to the times of their migrations, time of nesting, and relative abundance. A series of specimens of birds of any locality in the Southern and Western parts of the continent, with or without their nests and eggs, with the date and place of collecting carefully noted and appended, are much desired. Specimens may be sent to the Museum of Comparative Zoölogy, Cambridge, Mass.

Salt-water Insects.—Dr. J. L. Leconte writes us regarding the supposed Micralymna larva, mentioned in the July number of the Naturalist: "Your Staphylinide larva is probably that of *Micralymna Stimpsonii* Leconte (New Species of Coleoptera, Smithsonian Miscellaneous Collections, p. 57). It is much larger than the Greenland species, which is also in my collection. It ought to be common where it occurs." We have received from Professor A. E. Verrill specimens of the "puparium," or pupa-case, of the fly so abundant in Mono Lake, Cal., where it was collected by Professor B. Silliman. It is a species of *Ephydra*, closely allied to that figured (Fig. 4 *b*) in the July Naturalist, and is not allied to Eristalis as was supposed. In this connection we would state that Mr. Horace Mann desires us to say that he himself has not been nearer than ten miles to Lake Mono. He only knows that *some* Indians eat these insects.

Dr. Leconte thus writes regarding another salt-water insect: "In your notes on sea-insects, you do not refer to our singular Californian Staphylinide, *Thinopus*, with two species, found below high-water mark

on the wet sand. From the variegation of pale yellow and black they are singularly Crustacean-like, both in the larval form and in the perfect state."

Enemy of the Potatoe-bug.—I have seen, for the last few days, many of the western potatoe-bugs, with their larvæ, devouring the tops of the potatoes. I have also discovered an enemy in a bug often found on ripe berries, which has a very unpleasant smell, which belongs to the Cimicidæ, and is called Halys, which sucks the blood of the potatoe-bug. —Wm. J. McLaughlin.

GEOLOGY.

Glacial Marks in the White Mountains.—Since Mr. Vose's article was in print, he writes us that he has seen on Mount Kearsarge, one-third of the way up in the path, furrows running s. 20° e., and one-half the way up furrows running s. 30° e. Also in Ellis' Valley, about two miles above Jackson, on the east side of the river, close to the road, lines pointing just to the top of Mount Washington. He also found furrows on Mount Chocorua.

CORRESPONDENCE.

W. J. M'L., Centralia, Kansas.—The two plants you send are *Pentstemon Cobœa* Nuttall, the Beard-tongue, and which you say "grows on sandy or gravelly ridges in Nemaha county, Kansas, flowering in May and June;" and *Solanum rostratum* Dunal. Regarding the latter, you write that it "is an emigrant from the west. In the year 1860, I saw the first along the roadside and yards about Fort Riley, Kansas, and a few days ago I found several plants growing on and near the railroad track of the Central Branch of the Union Pacific Road. The leaf is much the shape of the common watermelon; flower yellow; the whole plant covered with spines; an annual; a noxious weed, from one to two feet high; much branched."

[We cannot attempt to name plants unless there is a proper botanical specimen sent; that is, the flowers adhering to a bit of the stem, the leaves adhering to another bit (or still better, when the size of the plant will admit of it, a flowering branch, or, in stemless plants, the scape with the root-leaves adhering to its base), and a statement as to how high it grows; whether woody or herbaceous; and whether wild or cultivated.]

W. C. F., *Eastham, Mass.*—The Turtle which you sent and which you say is the first specimen of the species you have seen on Cape Cod, is the "Musk Turtle," *Aromochelys odoratum* Gray. It is given in Agassiz's work on the Turtles of North America (Contributions to the Natural History of the United States, vol. 1, p. 425; vol. 2, pl. 4, young; pl. 7, eggs), under the name of *Ozotheca odorata* Ag. It has also been placed by the older writers in the genera *Testudo* (when all turtles were placed in that genus), *Cistudo*, *Sternothærus*, *Cinosternum*, *Staurotypus*, and *Emys*. The

specific name of *odorata* has held through the several changes that have been made regarding its generic position, though varieties of it have been described as distinct species by several authors. It is a pretty generally distributed species, ranging from Canada south to the Gulf of Mexico, and west to the Mississippi. In habits it is quite voracious and shy, preferring muddy ponds and rivers, and overflowed meadows, where it can easily hide itself. It is often found covered with a green confervoid growth, which also renders it less likely to be noticed. It has the habit of climbing trees overhanging the water, and basking in the sun, and will drop into the water on the slightest hint that it is observed.

The two insects inclosed were two species of wingless Ichneumon flies; one of them probably belongs to the genus *Pezomachus*. We have several wingless genera, and the genus Pezomachus comprises an immense number of species. Mr. E. Burgess informs us that in the pupa state the Pezomachus is winged, but that the wings drop off in transforming into the imago state. *Pezomachus* may be known from *Mutilla*, by possessing a harmless sting, which only serves as an ovipositor, and a smaller head, and by its very close resemblance to the winged Ichneumons.

W. H. G., Elmira, N. Y. — The moth you send is one of the Sphinges, *Thyreus Nessus*. It was first described and figured by Cramer, a Dutch naturalist. It is found from Canada and New Hampshire southward. The larvæ of this genus differ from most others of this family, in having a simple tubercle on the tail instead of the usual curved horn, as seen in the Potatoe-worm, *Sphinx Carolina*.

ENTOMOLOGICAL CALENDAR.

During this month the Seventeen-year Locust (*Cicada septendecim* of Linnæus) has disappeared, and only a few Harvest-flies, as the two other species we have are called, raise their shrill cry during the dog-days. But as this year has been marked by the appearance of vast swarms in the Middle States, we cannot do better than give a brief summary of its history, which we condense from Dr. Harris' work.

The Seventeen-year Locust ranges from South-eastern and Western Massachusetts to Louisiana. Of its distribution west of the Mississippi Valley, we have no accurate knowledge. In Southern Massachusetts, they appear in oak forests about the middle of June. After pairing, the female, by means of their powerful ovipositor, bores a hole obliquely to the pith, and lays therein from ten to twenty slender white eggs, which are arranged in pairs, somewhat like the grains on an ear of wheat, and implanted in the limb. She thus oviposits several times in a twig, and passes from one to another, until she has laid four or five hundred eggs. After this she soon dies. The eggs hatch in about two weeks, though some ob-

servers state that they do not hatch for from forty to over fifty days after being laid. The active grubs are provided with three pairs of legs. After leaving the egg they fall to the ground, burrow into it, seek the roots of plants whose juices they suck by means of their long beak. They sometimes attack the roots of fruit trees, such as the pear and apple. They live nearly seventeen years in the larva state, and then in the spring change to the pupa, which chiefly differs from the larva by having rudimentary wings. The damage the larvæ and pupæ do, then, consists in their sucking the sap from the roots of forest, and occasionally fruit trees.

Regarding its appearance, Mr. L. B. Case writes us (June 15) from Richmond, Indiana: "Just now we are having a tremendous quantity of locusts in our forests and adjoining fields, and people are greatly alarmed by them; some say they are Egyptian locusts, etc. This morning they made a noise, in the woods about half a mile east of us, very much like the continuous sound of frogs in the early spring, or just before a storm at evening. It lasted from early in the morning until evening." Mr. V. T. Chambers writes us that it is abounding in the vicinity of Covington, Kentucky, "in common with a large portion of the Western country." He points out some variations in color from those described by Dr. Fitch, from New York, and states that those occurring in Kentucky are smaller than those of which the measurements are given by Dr. Fitch, and states that "these differences indicate that the groups, appearing in different parts of the country at intervals of seventeen years, are of different varieties." A careful comparison of large numbers collected from different broods, and different localities, and different years, would alone give the facts to decide this interesting point.

Regarding the question raised by Mr. Chambers, whether the sting of this insect is poisonous, and which he is inclined to believe to be in part true, we might say that naturalists generally believe it to be harmless. No hemiptera are known to be poisonous, that is, have a poison-gland connected with the sting like that of the bee, and careful dissections by the eminent French entomologist, Lacaze-Duthiers, of three European species of Cicada, have not revealed any poison apparatus at the base of the sting. Another proof that it does not pour poison into the wound made by the ovipositor is, that the twig thus pierced and wounded does not swell, as in the case of plants wounded by Gall-flies which secrete an irritating poison, giving rise to tumors of various shapes. Many insects sting without poisoning the wound; the bite of the musquito, black-fly, flea, the bed-bug, and other hemipterous insects, are simple punctured wounds, and to a perfectly healthy constitution they are not poisonous, though they may grievously afflict many persons, causing the adjacent parts to swell, and in some weak constitutions induce severe sickness. Regarding this point, Mr. Chambers writes:

"I have heard — not through the papers — within a few days past of a child, within some twenty miles of this place, dying from the sting of a Cicada, but have not had an opportunity to inquire into the truth of the story, but the following you may rely on. A negro woman in the employment of A. V. Winston, Esq., at Burlington, Boone County, Ky., fifteen miles distant from here, went barefooted into his garden a few days since, and while there was stung or

bitten in the foot by a Cicada. The foot immediately swelled to huge proportions, but by various applications the inflammation was allayed, and the woman recovered. Mr. Winston, who relates this, stands as high for intelligence and veracity as any one in this vicinity. I thought on first hearing the story, that probably the sting was by some other insect, but Mr. Winston says that he saw the Cicada. But perhaps this proves that the sting is *not* fatal; that depends on the subject. Some persons suffer terribly from the bite of a musquito, while others scarcely feel them. The cuticle of a negro's foot is nearly impenetrable, and perhaps the sting would have been more dangerous in a more tender part."

We figure the Hop-vine Moth and the larva (Fig. 1) and pupa, which abound on hops the last of summer. Also, the *Ilythia colonella* (Fig. 2; *a*, pupa), known in England to be a parasite of the Humble-bee. We have frequently met with it here, though not in Humble-bees' nests. The larvæ feed directly upon the young bees, according to Curtis (Farm Insects). The Spindle-worm Moth, *Gortyna zeæ*, whose caterpillar lives in the stalks of Indian corn, and also in dahlias, flies this month. The withering of the leaves when the corn is young, shows the presence of this pest. The beetles of various cylindrical Bark-borers and Blight-beetles (*Tomicus* and *Scolytus*) appear again this month. During this month the Tree-cricket, *Œcanthus niveus* (Fig. 3), lays its eggs in the branches of peach trees. It will also eat tobacco leaves.

Fig. 1.

Fig. 2.

a

We figure (Fig. 4) the moth of *Eudalimia subsignaria*, the larva of which is so injurious to shade trees in New York City. It is a widely diffused species, occurring probably throughout the Northern States. We have taken the moth in Northern Maine. We have received from Mr. W. V. Andrews the supposed larvæ of this moth. They are "loopers," namely, walk with a looping gait, as if measuring off the ground they walk over, whence the name "Geometers," more usually applied to them. They are rather stout, brown, and roughened like a twig of the tree they inhabit, with an unusually large rust-red head, and red prop-legs, while the tip of the body is also red. They are little over an inch long. The supposed "Tortrix" larva, referred to in the Calendar for June, is the Gartered

Fig. 3.

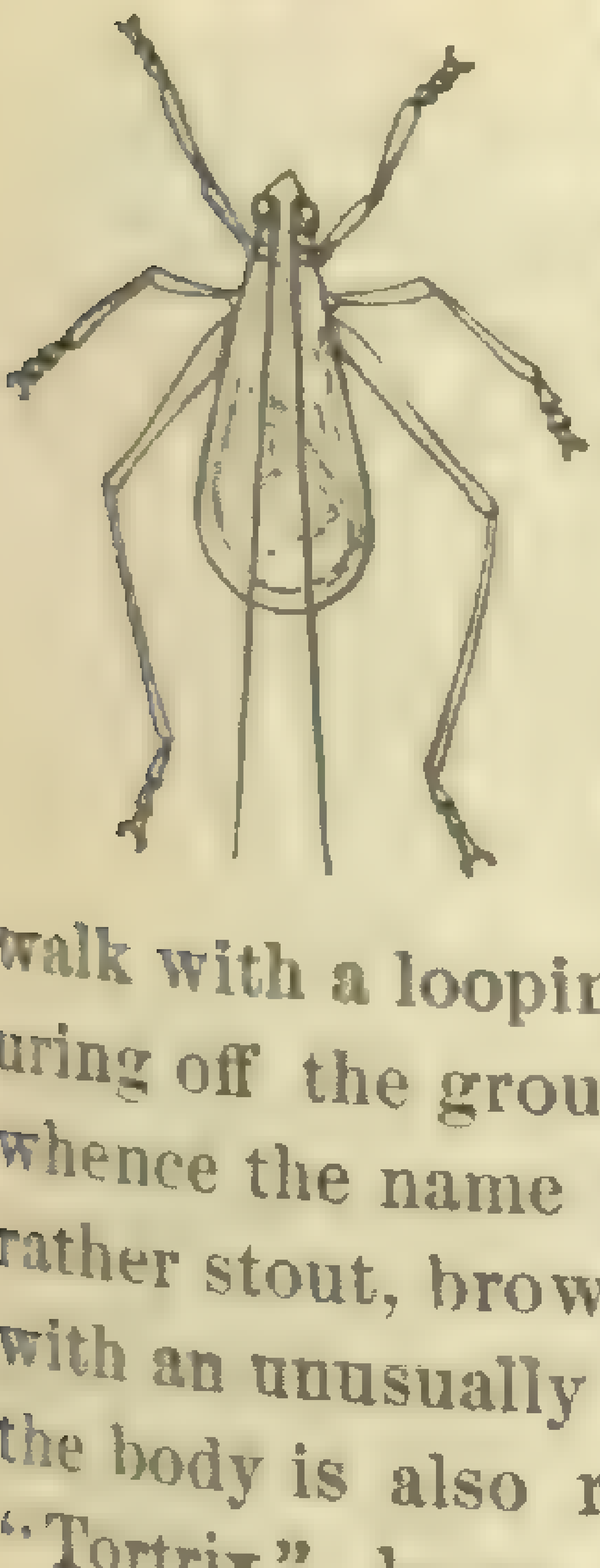

Fig. 4.

Plume-moth, *Pterophorus periscelidactylus* of Fitch. We were able to raise the moth from larvæ forwarded by Mr. Read. It appeared in one rearing-box June 26. Its habits are very fully described in the first report of Dr. Fitch on the Injurious Insects of New York.

A word more about the Seventeen-year Cicada. Professor R. Orton writes us from Yellow Springs, Ohio, that this insect has done great damage to the apple, peach, and quince trees, and are shortening the fruit crop very materially. By boring into twigs bearing fruit, the branches break and the fruit goes with them. "Many orchards have lost full two years' growth. Though the plum and cherry trees seemed exempt, they attacked the grape, blackberry, raspberry, elm (white and slippery), maple, white ash, willow, catalpa, honey-locust, and wild rose. We have traces of the Cicada this year from Columbus, Ohio, to St. Louis. Washington and Philadelphia have also had a visitation."—A. S. P.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Long Island Historical Society, *Natural History Section. Brooklyn. N. Y.*—At a May meeting, a paper was read by Mr. E. Lewis, jr., on "Evidences of Coast-depression along the Shores of Long Island." It is found, by a series of observations made by Mr. Lewis and others, that large areas, known to have been formerly meadow swamp and woodland, are now permanently beneath the water. Some important changes have taken place along the flat shores within historic times. Remains of swamps with fresh-water vegetation are abundant, from four to nine feet below the surface of the meadows, along the southern side of the island, in the bay which intervenes between the beach and the uplands. In one instance roots of swamp vegetation, fast where they grew, were found quite near the beach, under ten feet depth of water. Stumps of the White, or Swamp-cedar (*Cupressus thyoides*), occur in great numbers, fast in the peaty meadows and salt marshes, which are now permanently covered with salt-water. Near Fort Hamilton are the Dyker Meadows, so-called, which extend inland nearly three-fourths of a mile. The upper end is a fresh-water swamp, with cedar and other trees. Where the tides overflow the trees are dead, many of them still standing. Lower down, or nearer the bay, stumps only remain; these abound in the meadows, and are in a good state of preservation. These meadows extend beneath the bay; and one-fourth of a mile from the shore-line, stumps of the cedar, from two feet to three feet in diameter, have been found. It is probably continuous with similar meadows on the opposite side of the river.

A general invasion of the beach along the coast has occurred within historic time; it having been thrown inland, submerging the meadows. From this cause large masses of old meadows are often torn up by waves

outside the beach. There is evidence that the great bay, extending from near Islip to Bellport, was formerly a fresh-water swamp, from which streams of considerable size emptied into the ocean. It is now a shallow bay, in which, about a century since, were great numbers of stumps; the fresh-water and upland vegetation having been destroyed by the invasion of the tides. A line of fence-posts near Southampton, along the shore of the ocean, were exposed a few years since by an extremely low tide which followed a violent storm. These had been buried with sand and covered with water not less than a century, and the line was found to correspond with early surveys of the town. Submerged meadows are found in many places on the north shore of Long Island. A few miles east of Fort Jefferson, it extends half a mile from the shore, is solid, compact, and lies in places sixteen feet below the surface of the water at low tide. A general wearing away and undermining of the headlands around the island has long attracted attention. In constructing the Erie Basin, near Red Hook, New York Bay, Mr. G. B. Brainerd, engineer, found the following series of deposits. The measurements were taken at various points where the water was ten feet deep at low tide.

1. Two feet of mud,—ordinary sediment of the bay.
2. One foot of yellow sand.
3. Six inches of aluminous deposit, quite hard.
4. Ten feet of *compact decayed peaty meadow.*
5. Layer of extremely hard micacious clay and sand, beneath which was found mud, rather soft, but the depth and character of which was not determined.

During the summer of 1867, John Nadir, U. S. Engineer at Fort Hamilton, carefully examined the underlying formation around Fort Lafayette, for the purpose of determining whether it would admit of the erection upon it of heavier walls. By a series of borings, the earth was penetrated to the depth of fifty-three feet, at points between 800 and 1.000 feet from the shore, where there was ten feet depth of water at low tide. The deposits were as follows:

1. Twenty feet of coarse sand and gravel, with a few broken shells.
2. Three feet of *decayed marsh or meadow*, with diatomaceæ and spiculæ of sponges and shells.
3. Seventeen feet of gravel and sand, with many broken shells.
4. Thirteen feet of mud, quite compact, which appears to have been a marsh with scanty vegetation, rather than a meadow. The vegetable remains brought to the surface by the sand-pump are bits of cedar, and fragments of what appears to be salt-marsh grass, but too much decayed to be fully identified. In this formation great numbers of shells were found and identified by Mr. A. R. Young, Conchologist of the Section, as belonging to species now common on this coast. Most of the specimens are in an excellent state of preservation. Among them are *Nassa obsoleta*, *Anomia ephippium*, *Mya arenaria*, *Crepidula fornicata*, *Solen ensis*, and *Mytilus edulis.* It may be stated in this connection that similar de-

posits, at corresponding depths, have been found on the opposite side of the river in the vicinity of Fort Wadsworth.

The investigations made on the Long Island shores, confirm the conclusions arrived at by Professor G. H. Cook, in his report on the Geology of Cape May county, N. J., that the oscillation of land on this coast during the last epoch has been one of subsidence. If the formation found near Fort Lafayette be, as it evidently is, an ancient marsh, the depression has been at least fifty-three feet.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. *Seventeenth Annual Meeting, at Chicago, August*, 1868.—The objects of the American Association for the Advancement of Science are, by periodical and migratory meetings, to promote intercourse between those who are cultivating science in different parts of North America; to give a stronger and more general impulse, and a more systematic direction to scientific research in our country, and to procure for the labors of scientific men increased facilities and a wider usefulness.

The seventeenth meeting of the Association will be held at Chicago, during the week commencing on Wednesday, August 5, 1868, at 10 o'clock, A. M.

It will be the aim of the Local Committee to make the sojourn of the members of the Association in Chicago pleasant, as well as profitable in a scientific point of view. The usual local courtesies will be extended to them, both by private citizens and public bodies. Resolutions of invitation, and offers of the use of rooms, libraries, collections, etc., have already been passed by the Academy of Sciences, the Historical Society, the Young Men's Association, the University of Chicago, the Board of Trade, and other bodies.

With the view of insuring as large a meeting as possible, special attention has been given to the facilities for coming to and returning from the city over all routes of travel. Arrangements have been made with the railroad companies, by which return tickets will be furnished free to those who attend the meeting. Doubtless the same concession will be granted by the proprietors of some of the steamboat lines.

BOOKS RECEIVED.

Observations on Crania. By Jeffries Wyman, M. D. Boston, 1868. 8vo, pp. 34.

Monograph of the Alcidæ. By Elliott Coues, M. D. Philadelphia, 1868, 8vo, pp. 31.

List of Birds collected in Southern Arizona. By Dr. E. Palmer; with remarks by Dr. Elliott Coues. Philadelphia, 1868. 8vo, pp. 4.

The Portland Catalogue of Maine Plants. Published by the Portland Society of Natural History. Portland, 1868. 8vo, pp. 12.

Popular Journal of Natural History. Third series, vol. 4, no. 4 (and extra number); vol. 5, no. 1, 2, 8vo. Copenhagen, 1868.

The Gospel in the Trees. By Alexander Clark. Philadelphia, 1868.

Cosmos. April 25, May 16, 23, 30, June 6. Paris.

The Field. May 23, 30, June 6, 13, 20. London.

The American Bee Journal. June. Washington, D. C.

Chemical News. June. New York.

THE

AMERICAN NATURALIST.

Vol. II.—SEPTEMBER, 1868.—No. 7.

DEATH OF FISHES IN THE BAY OF FUNDY.

BY A. LEITH ADAMS, M.D.

AMONG all the fluctuations of opinion respecting the nature of the causes to which the phenomena of the physical sciences are referrible, none in so short a period of time have undergone greater changes than we see represented in the history and progress of Geology. The first observers, more engaged in the discovery of appearances than in seeking to divine their causes, were led, by the wonderful but imperfect scenes constantly opening out before them, to infer, that the mysterious and extraordinary assemblages of strata and organic remains therein imbedded were owing to causes in every way distinct, both in kind and degree, from the laws which now govern the material universe. But the gigantic strides made in this science during the last half century have induced philosophers to conclude that throughout the vast periods of time of which geology takes cognizance, there has never been any intervention to the working of fixed and invariable laws of change. The elevation of land, distortion and dislocation of rocks, together with their assemblages of organic remains, were considered by the early observers to have been brought about by sudden and violent oscillations of level, earthquakes and diluvial agencies far exceeding

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both in extent and intensity any similar phenomena of which history has preserved records. But the modern progress of enlightenment has greatly modified such opinions, and now geologists, not content with the speculations of their predecessors, are earnestly endeavoring to interpret the GREAT STONE BOOK by comparing the former mutations in the earth's surface with those of our own times, and thus the science is being gradually devested of the supernatural appearances and fanciful conjectures, which, for many years, not only encompassed but also retarded its advancement. Even the simple enumeration of the discoveries which of late years have brought about this grand revolution in the thoughts and opinions of the modern school of geologists would far exceed our limits; we will therefore elucidate the subject by an example which came under our own notice, and attempt to show the reader that many similar appearances among the rock formations may possibly have been occasioned by similar causes.

In the Bay of Fundy, opposite the Island of Grand Manan, there is a large gap in the coast-line named Passamaquoddy Bay, into which several fair-sized rivers drain. One, called the Magagudavic River, is reached by means of a long fiord of several miles in length. At a short distance westward, there is a small creek named Anderson's Cove, formed in the trappean rocks of which the coast-line is composed. These beds are considered by geologists as belonging to the Devonian or Old-Red Sandstone formations of Southern New Brunswick. Anderson's Cove is, in fact, the sea-ending of a ravine down which runs a small stream into a very muddy lagoon of upwards of 1,300 feet in circumference. The latter is oval in shape, and communicates directly at high tide with Anderson's Cove by means of a narrow and rocky channel, filled with masses of amygdaloid trap, fragments of which are mixed with the mud forming at the bottom of the lagoon. There is a beach of sand in front of the lagoon, besides a sea-wall formed of sand and masses of rocks and

stranded logs of wood piled in disorder along the shore; so that, excepting during furious gales, the only direct communication with the lagoon is by the passage just mentioned. During high tide the waves rush up this channel with force stirring up the mud of the lagoon, when the water in the basin frequently assumes almost the consistency of pea-soup. Thus the lagoon is a shallow morass of brackish water at low tide, receiving a constant supply of fresh water from the stream which is depositing its debris on the slimy bottom; moreover, land-shells and other organic remains are being conveyed by the stream or washed by the rain into the basin, whilst on the other hand the powerful tidal wave of the Bay of Fundy brings up quantities of marine Mollusca, Radiata, etc., remains of which strew its bottom and sides. Such, in all probability, has been the usual state of matters in this quiet corner of the bay for unreckoned ages, broken only at long intervals by occurrences such as we shall now describe.

On the 24th of September, 1867, a very heavy gale from the west blew directly into Anderson's Cove, and more especially on the entrance of the lagoon at the eastern end. The result was, that the mud became disturbed to an unusual extent, and the amount of the water in the area was doubled in quantity. During the gale enormous numbers of dead fishes were seen floating on the surface of the turbid waters of the morass, and on the following morning when the hurricane had subsided, a spectacle presented itself, baffling anything of the kind observed by the residents on previous occasions. The entire lagoon, from its entrance to the limits of the tide, was covered with dead fishes. The species, with the exception of a few mackerel and New York flounder, was found to be the young of the American herring (*Clupea elongata*) averaging about six inches in length. This fish is said to spawn in the neighborhood, and usually large shoals had been observed for some weeks previously in and about Anderson's Cove. The author chanced to be in the vicinity about a fortnight after the occurrence just mentioned,

and, when on his way to the scene of the disaster, was made uncomfortably aware of the proximity even at the distance of two miles, by an intolerable stench from decomposing fish, contaminating the atmosphere in every direction for five miles around Anderson's Cove. The smell was found to emanate not only from the latter, but also from the fields around, where many cart-loads had been deposited by the farmers; nevertheless, the quantities of rotting fish around the margin of the lagoon seemed very little diminished by the amount taken away for manure, not to mention what had been consumed by the flocks of gulls and crows which were feeding sumptuously on their remains.

After skirting the shore of Anderson's Cove we reached the entrance of the narrow, tortuous passage leading to the lagoon; here the first traces of the disaster were manifested by enormous quantities of fishes, impacted between and among the fallen masses of rock, which were literally besmeared all over with the crushed flesh and bones of herrings, whilst the sides and bottom of the lagoon were covered with their entire and mangled remains, forming heaps several feet in depth, more especially in places where there had evidently been eddies, whilst the limits of the tide were distinctly marked by a pile of their bodies which fringed the basin of the lagoon. On the muddy bottom they lay as thick as herrings in a barrel, interspersed with remains of crabs, lobsters, sea-mussels, and other shells, together with enormous numbers of the dead bodies of star-fish, etc.

A friend, who resides in the neighborhood, suggested that the shoal had been chased into the inclosure by sharks, or other predaceous fishes, and were subsequently suffocated by the muddy waters of the lagoon. But the mangled remains in the passage and shallow water in Anderson's Cove, together with the fury of the gale, rather seemed to indicate that the vast assemblage, getting into shallow water, and under the influence of the breakers, was driven pell-mell up the passage and against its rocky sides into the lagoon, where

the survivors perished from the combined fury of the waves and the muddy waters. During our examination of the bottom of the lagoon it was apparent, even in the short space of time that had elapsed since the gale, that many of the fishes had been completely covered over by mud conveyed or re-disturbed by every tide, and deposited also from the water-shed around the morass. No doubt at that rate the whole of the organic remains, before long, became buried in the soft mire, and perhaps some geologist, in the far distant future, will be speculating on the cause or causes which brought about such a vast congregation of marine and land animals in so limited an area, just as he now theorizes on the probable causes of those vast assemblages of fossil animals he is accustomed to observe in many rock formations. For we have only to suppose one or more geological epochs to have passed away, and a slight elevation of the land, when, if a section were made of the spot where this lagoon now stands, there would be found an alluvial deposit on the surface, succeeded by a sedimentary stratum containing fragments of the Devonian trap-rock of the neighborhood, accompanied by the vast assemblage of organic remains just described, and followed, perhaps, by similar objects at greater depths, succeeded, no doubt, by traces of the Glacial epoch, which are so vividly portrayed on the surface of the surrounding country at the present day; and lastly, the old Devonian conglomerate in which the lagoon now stands. And whilst each will supply memorials of its own peculiar but relatively distant epochs, none will furnish more lasting and wonderful phenomena than the deposit which contains the fishes destroyed during the gale of the 24th of September, 1867.

Occurrences similar to that just described are apparently not common, at least along the coast of the Bay of Fundy, but enormous shoals of herrings and other fishes are met with at stated seasons, so that the accident of the 24th of September might occur again anywhere under the same favorable conditions. Moreover, it may be pretty confidently

surmised, that the fish stranded in the lagoon were but a very small portion of the original shoal which entered Anderson's Cove, and thus, supposing the locality had been many times larger, there would have been no diminution in relative density of the dead fishes on its area.

Another example is recorded in the Journal of the Geological Society of London.* Thousands of dead fishes, thrown on the coast of Madras, were afterwards enveloped in sand and mud along with other marine animals and plants, so as to form a densely packed stratum of fishes, etc., of unknown breadth, but extending for a vast distance along the coast-line. The fishes were supposed to have been destroyed by the enormous fall of rain from the south-west monsoon, rendering the sea-water less saline. Be that the cause or not, it is by such facts as these, compared with similar phenomena of by-gone epochs, that the geologist is enabled to arrive at just conclusions, and it is in this way that the science of geology is progressing.

THE ORCHIDS.

BY C. M. TRACY.

It was the greatest step forward ever made at once in the study of plants, when Jussieu found out that there was a grand line of division running through the whole vegetable kingdom, with seeds on one side that might be split into two parts like the pea and the acorn, and those on the other that could not, like the kernel of corn and the grain of barley. For (not to tire the reader with technical words) it was directly seen that the same line would clearly distinguish between those plants that had a bark and made new wood between that and the older wood within, and thus *grew on*

* June, 1862.

the outside—between these and such as had no bark, but made the new wood in the midst of the pith, and so *grew on the inside.* Again, the *outside-growers*, like the oak and the pea, always have leaves with little veins forming an irregular net-work all through them; but the *inside-growers*, as the corn and the lilies, have the veins of their leaves running straight from one end to the other, and not netted at all, so that we can split such a leaf into strips very easily, and this makes a palm-leaf hat a possibility, which otherwise could not be. By this discovery Jussieu divided the vegetable kingdom quite as clearly and effectually as Alexander of Parma did the Dutch Republic, and without violating the rule of nature at all, wherein he had a great advantage over the other.

We speak of this natural difference in plants, because in talking over these royal families we have come to the point when we must step over this remarkable line. Most flowering plants are *outside-growers* (botanists say "Exogens," and the reader may too, if he chooses; it means just the same thing), and they all have their leaves netted with veins and seeds separable into two halves. But the *Orchids*, of which we now speak, are *inside-growers* (or "Endogens"), have leaves that may be stripped into ribbons, and grow from seeds as indivisible as a buck-shot. Hence, there is no need to mistake this family for either of the preceding,* not even in a single case; but as we have set out to indicate a few plain marks for the ready recognition of each order, it remains to state them for that under present notice.

If we examine an apple-blossom we find there are five leaves or petals in it, and all of them are just alike in form and size. This makes what is called a *regular* flower. The number matters nothing; the lily has six petals, the spiderwort three, the willow-herb four, and the enchanter's nightshade two, and yet all are perfectly regular, for their form and size are the same all the way round the flower. Any

*The Asterids and Pisids, of which we have spoken in Vol. I. of the NATURALIST.

variation from this principle makes the flower *irregular*. The Pea-flower is irregular both in form and size, that of the Candytuft is so in size only, and that of the Larkspur chiefly in form. The Iris has a flower alike on all sides, and therefore regular, though the petals are in two sets of different shape; but the allied Gladiolus, with petals all of nearly the same size, is quite irregular, for their diverse form is such as turns the flower quite over to one side.

Now a certain mark of an Orchid is to have irregular flowers. In other families there is often a mixture of the two styles, but nothing of it here. And the most common observer will bear me out in calling these flowers irregular; for, setting aside all technicality, many cannot be reduced to any form, plan, or design, without a liberal stretch of confidence and ingenuity. So wide is their range of figure, and so perfectly bizarre are many of the shapes in which they appear, that one is tempted sometimes to believe they are animated creatures under some strange disguise of enchantment. Lindley tells us there is scarcely a common reptile or insect to which some of them have not been likened. Bees, crane-flies, long-legged spiders, toads, *et id omne genus*, all find the queerest of representatives in these protean blossoms. But more of this presently.

The organs called stamens and pistils are of great importance in vegetable nature. Invested with all that pertains to reproductive purposes, they have, since Linnæus at least, been held to represent the sexes of animals, and perhaps we can say nothing better about it. A striking circumstance with regard to them is, that while we may trace much affinity between both these organs and other parts of the plant, respectively, we can rarely find any relationship between the stamens and the pistils directly. We may, by cultivation, make stamens change into petals, which are obviously only leaves refined; but we rarely or never succeed in making pistils do any such thing. If they ever change (as they do sometimes, without asking our leave), it always seems to

be into green leaves directly; and, for a general expression, we may say that a stamen never turns into a pistil, nor *vice versa*.

But the Orchids are above the observance of any rule so exacting. Ignoring the usual distinctive position of these important organs, they constantly place them one upon the other, forming a column-like structure, in which the important part of a stamen, the anther, and the necessary part of a pistil, the stigma, are both to be distinguished, but nothing more. For the rest, you may call it a stamen bearing a pistil or the reverse; it is either, or neither, as you choose. The common, typical structure of the flower in respect of these organs, is entirely set aside; and another and different one appears, the presence of which, always constant, is the second mark of this strangely beautiful order.

The third badge is to be found in a circumstance of great significance in connection with those already named, though in itself not of much value as a mark. The orchids are all perennials. No annual plant, shooting up under the influence of the vernal sun, to perish and pass away when the next equinox shall bring the changing season to a less genial temper, appears as a member of this privileged and gorgeous race. Let it be for the Asterids, who enjoy being everywhere and everything, to revel like May-flies in the fleeting hilarities of annual life; let the Pisids, who have plenty of trees mighty as towers, to spend a fraction of their riches in like manner; but the Orchids will take a middle station, neither storing up millions in vast trunks, nor squandering them in perishing herbage, planting seed liberally and largely, but giving the nursling always that royal blood that shall insure a life beyond the brief period of a single spring, and one succeeding summer.

Or if we esteem this as too common and uncertain for a sure mark of a family like this, we may take one that is more minute, but rather more characteristic. Every Orchid has a pod for its fruit, with innumerable small seeds within.

Now pods, if they are round, that is, alike on all sides, bear their seeds in two different ways. Either they have a column of some sort running up through the centre of the pod, and the seeds attached to this, or they have no such column, and the seeds hang upon the inside of the outer wall. There is a great difference in these two modes, greater in fact than it is best to trouble the reader with at present. It will be quite enough if he finds out what we mean by the modes themselves. Now if we cut across the pod of any Orchid, just as we would slice a cucumber, the seeds will be found growing *on the sides* of the interior, and *not at the centre.*

If, then, we find plants with these marks, to wit:

I. Irregular flowers,

II. Stamens and pistils consolidated,

III. Perennial habits; or seeds round the sides of the pod,

—then we are safe in looking up to it as a well-accredited member of this regal order. Among the sweltering forests and jungles of India may be found a small family that resembles these considerably, having flowers not quite regular, and stamens and pistils partly coherent; but we know them to be mere pretenders, when we find their seeds always in the centre of the pod instead of on the walls.

Having thus outlined the characters of this family at some length, it remains to say a word upon their properties and distribution. Two circumstances only can bar these plants from any climate, namely, frost and excessive drouths. Nay, frost itself, if the degree be not that of the arctic, is not enough, for there are seventeen genera and fifty-one species reckoned by Gray in the Northern States east of the Mississippi, and one of them, Calypso, is nowhere seen but in the cold bogs of the Canadian region. Never rising into trees, and only rarely to be called shrubs, they stand as small, but most remarkable herbs in all cooler latitudes, while in the moist heats of the tropics they luxuriate as climbers, or take on that very peculiar style of growth sometimes, but wrong-

ly, called parasitic. All through the dense forests of Brazil, in the thickets of the Orinoco, and along the thousand shaded crags and valleys of the Andes, these plants are found in myriads, clinging to the rocks, to old and decaying trees, or to the stronger arms of those not yet dead, strapping their naked, onion-like bulbs to any chance support by roots that seem quite as much like rope-yarns, and with green leaves starting freshly in such curious situations, pushing out long swinging stems of flowers, that dangle hither and thither like strings beset with white or red or bronzy butterflies. Varied with an excess that is perfectly reckless and prodigal, a new form meets the observer at every turn. One botanist dismisses the subject in despair; "a whole life," he says, "would be too short for the figuring of the Orchids of the Peruvian Andes alone." What, then, is to be said of the multitudes that grow elsewhere, from the Rio de la Plata even as far hitherward as the Carolinas? These independent air-plants, as they are often called, have cut loose from the soil, with princely blood too aspiring for a seat so lowly, and mounting to heights and places inaccessible to their, perhaps, envious neighbors; while in turn they scorn to owe them for any but the merest holding-ground, they grow and bloom and triumph like a bird upon the main-truck, only satisfied with the wildest of perches, nor greatly caring even for that. Often the flowers are redolent of the most powerful and enchanting fragrance, often they are gorgeous with lines that shame the pencil; always they come in such endless diversity of form—form so lovely and so provokingly strange—that we are left at a stand,—there is nothing we can say about them save that God has made and given them beauty in such manner and degree as he has to nothing else among all his wonderful works.

These plants are not less abundant in other regions than those named. Europe has a great many of the terrestrial or rooted sorts, and the Cape of Good Hope is plentifully supplied with the same. The Southern United States also fur-

nish these species freely. But for the other class, the air-plants, we go to the East and West Indies, to Central America and Mexico, to Madagascar and the Indian Islands, and to Nipal and Southern China, and find them in the damp, hot, shaded forests, here, there, everywhere, in thousands upon thousands. Three hundred and ninety-four genera, and at least three thousand distinct species have been described: and no one supposes that more than a beginning has been made. To what an extent the enumeration, if carefully made, might reach, we cannot conjecture; the work is not only almost endless, but is very difficult besides. It is here that we meet with a fact to make the botanist stop and doubt his own eyes. When we have, in some cases, carefully examined and described certain species, so that we know their flowers and growth perfectly, we think, and can distinguish them at sight, all at once,—lo! before us is a plant consisting, as it were, of all these species fused together, with half a dozen kinds of flowers that we have known familiarly, and never saw in connection before, and never suspected of the least alliance, all growing comfortably together on the same spike. Thus was Schomburgk startled, in Demerara, when he found a single plant bearing at once the flowers of a Monachanthus, a Myanthus, and a Catasetum: as if, forsooth, botanists had not long before settled these to be, not only different species, but separate genera. So were the British students surprised, when the same thing afterward appeared in the gardens at Chatsworth; and, later still, when a plant bore two species of Cycnoches very unlike, but with other flowers whose intermediate forms completely connected the two.

Shall we say with Lindley, that "such cases shake to the foundation all our ideas of the stability of genera and species." Not at all. If we find such combinations, it simply disproves former suppositions, and shows what we thought permanent and natural divisions to be those of mere varieties, usually observed, it is true, but capable of being thrown

aside, and pointing not to any fixed law of nature. We can well afford to take facts as they are given to us, without seeking to force our preconceived notions on things around us, or going into despair because we discover the falsity of a long-established error.

Attracted by the glorious loveliness of these plants, the florist, if he be rich enough, often adorns his establishment with them. The terrestrial kinds he does pretty well with; he can grow Cypripediums, Ophryses, Herminiums, Acanthophippiums, and the like, with no special trouble. But when he comes to the other form, his cares begin. He must hang them up in baskets of dry lumps of peat, upon his greenhouse rafters; or tie them on blocks and sticks and put them in high and airy places, or perhaps build a pile of such loose peat-lumps and put the bulbs on the top. Nay, some are too particular for him to meddle much with them; he must import the rock or stick or dead limb with them already on it, and then he may not succeed after all. Mrs. Loudon complains, that with all the plans of glazing houses with colored glass, using double sashes, training vines over the roof, etc., it has still been impossible to flower some kinds to satisfaction. And all this without saying anything of the hot, steamy atmosphere that must be kept up, half boiling the gardener alive like a Turkish bath, or anything of the more ordinary trouble of importing them from far countries, and having them arrive in doubtful condition, requiring every art for their restoration, and constantly threatening the loss of all expense incurred. Yet, after all, some succeed finely, and are rewarded with the wondrous loveliness of Stanhopeas, Oncidiums, Catasetums, Cattleyas, Dendrobiums, and Vandas, filling their hands with labor, it is true, but their senses with beauty and celestial odors, and their hearts with yet more exquisite perfumes. Witness the impressions these plants may create, in the case of the charming Peristeria, the "Flower of the Holy Ghost," before which the Catholic cannot restrain his devotion. In its pure

centre, as in the dearest of nests, sits the imitative organ, in the semblance of an immaculate dove, so spotless and serene in its seeming repose, that we cannot wonder that those whose faith makes hallowed emblems of all things thus suggestive, should have paused, awe-stricken at the first view, and murmured in a half-whisper, "*Ecce Spiritus Sanctus!*"

In speaking of the previous orders, we have considered their degree of usefulness to man. But here there is very little to be said of the kind. Hardly a family among all plants has so little known utility, and here, of course, the real royalty is all the plainer to be seen. The nutritive drug called Salep, and the peerless aromatic, Vanilla, are the most important products of this immense concourse of strangely beautiful things. A few are valuable as medicines, as the Coral-root, the Ladies' Slipper, and one or two more. This is about the end of this part of the story, for, as hinted at the outset, the Orchids are no princes of wealth and treasure, but are royal in their incomparable and exhaustless world of beauty, the fairies and spirit-kings of the vegetable sphere.

We found in the last family that most cogent proof of superior rank and royal origin, the power of spontaneous motion, and a life approaching that of animals. The same thing is revealed here. Not only do several genera have flowers that spring and close in a twinkling to catch the insects that unluckily settle on them, or to resent the touch that profanes their floral serenity, but one, at least, does more than this, and keeps one petal always moving, like a finger pointing this way and that, up and down, as if for entertainment, or perhaps counting the legions of some invisible host whose numbers

"Walk the earth
Unseen, both when we wake and when we sleep."

We have prattled enough over this family, and yet it is hard to restrain the thoughts and the pen, when considering

a subject so full of charms. It is not mere practical usefulness that entitles this or that production to our notice; the graceful and the beautiful have place in nature, prominent and unquestioned, and if we but listen a moment, we shall hear the pulsations of the inner heart that respond to them, beat for beat. And we shall do well to heed it, and not be angry with ourselves if, stealing a brief space now and then from sterner employments, we give ourselves to the contemplation and enjoyment of that generous and spiritual delight wherewith a bountiful Creator plainly designs to refresh the weary and jaded spirit. We cannot overlook mere beauty here, for the flowers tell us

"Uselessness divinest,
Of a use the finest,
Painteth us, the teachers of the end of use;
Travellers, weary eyed,
Bless us, far and wide;
Unto sick and prisoned thoughts we give sudden truce,
Not a poor town-window
Loves its sickliest planting,
But its wall speaks loftier truth than Babylonian vaunting."

THE BIRDS OF PALESTINE AND PANAMA COMPARED.

BY EDWARD D. COPE.

It is only lately that means of viewing any class of animals, which the Creator planted in the Holy Land, have been put at our disposal. As it is in the region which appears to have been selected as the first residence of man, an idea of superiority naturally attaches to its products; though we know, indeed, that all rich lands,—such as "flow with milk and honey,"—are prolific of the many outbirths of his manifold laws.

So little has this anciently known region been the field of scientific study, that, excepting among plants, our knowl-

edge has not approached completeness, until the publication of the late researches of Rev. H. B. Tristram.

Palestine, with its exceeding diversity of surface, its Carmel and Tabor, its Lebanon and Bashan, its plains, its deep quiet valleys, its rugged canõns and lake shores, presents scenes fitted for the habitation of all the forms where adaptation to nature must play a part; yet how different the inhabitants from those of similar situations in our own land, equally given to man for his habitation and place of development!

Tristram noticed 322 species of birds within the range of the ancient territory. Of these, 230 were land, and 92 water birds, *i.e.* Natatores and the wading Cursores. Of the 230, seventy-nine are common to the British Islands, and thirty-six of them are found in China, but a small proportion extending their range to both these extremes. Of the water birds, which are always more widely distributed, fifty-five of the ninety-two are British, and fifty-seven Chinese. Twenty-seven appear to be confined to Palestine and to the immediately adjacent country; the largest of these is a crow.

Taking the 230 land birds at a glance, we find the utter absence of so many of the well-known forms that enliven our grounds and forests. The absence of Tanagridæ ("wood-warblers") and Icteridæ ("black- and hanging-bird" types) changes the aspect of the bird-fauna at once. What have we here, then, of nine-quilled Oscines to enliven the meadows like our swarms of blackbirds, or fill the tree-tops and thickets with flutter like our wood-warblers? Nothing; for the twenty-four species of finches, Fringillidæ, will but balance our own, though the genera are all different but four, and they the most weakly represented by species. We must look to the higher series, the ten-quilled song-birds, for the missing rank and file. While a much larger extent of the Eastern United States possesses fifty species of these types, the little Palestine has already furnished a list of one hundred and twenty-eight. First, of the crows which verge

nearest Icteridæ by the starlings, we have thirteen species against five in our district of the United States, and not less than seven of the type-genus Corvus, to one common and two rare. Two of the larger species, the ravens, gather with the vultures in the valleys of Hinnom and Jordan, and make the rocks of Zion resound with their coarse cries. If we turn to the cheerful larks, we find the proportion again the same; fifteen species for Palestine, and one for the whole United States. One congener of our species occurs there; the other genera call to mind the African deserts and Russian steppes. The Motacillidæ, again, are ten to one against our fauna, enlivening every run and puddle with their wagging tails and prying ways. We have two Tanagridæ to imitate them, besides the one true relative. In swallows we are about equal, and in the forest-hunting Paridæ—titmice and wrens—we exceed a little; but the comparison of Sylviidæ and Turdidæ is most striking. These highest of the bird series, especially made to gladden man's haunts, and cheer wild nature as well, with song, exceed in number all the other ten-quilled Oscines together inhabiting Palestine, amounting to seventy-five species. In our corresponding region of the United States, there are nineteen species. It is true no mocking-bird or wood-robin is known away from our shores, but Palestine has the nightingale, the black-cap, and the true warblers, or Sylvias, which, while they glean from shrub and tree their smallest insect enemies, as do our equally numerous small Tanagridæ, have much louder and sweeter voices. But the balance of distribution of organized types has more developmental and geological, than any other kind of significance.

Our solitary bluebird represents the long-winged Turdidæ; in the Holy Land there are twenty species corresponding, though none are of our genus. There are, indeed, but three genera of these two families common to both countries. One of these, Lanius, the butcher-bird, occurs here in one rare species, in Palestine in six.

Turning now to a lower series, we look in vain for Clamatorial perchers; that series which gives us the fierce kingbird and querulous pewee, and which peoples South America with thrush and warbler and shrike and tree-creeper. We are induced to ask, then, has the old world a period the start of the new? or were the respective countries to be forever stamped with the marks of rank and breeding. We cannot answer these questions now, but will see what other regions have to show.

In taking a hasty glance over the lower groups, in which the carotid arteries begin to be double, as the Syndactyli, we find Palestine too far from the tropics to present us with much array; but in the related Zygodactyles our forest-crowned continent must claim great preëminence. The oaks of Bashan and Cedars of Lebanon had but a solitary Picus to probe their wounds, while we have eight in the immediate neighborhood of latitude 40° in our Eastern States.

I will close with the birds of prey. Four swamp hawks, eleven species of falcons, four kites, and eight native eagles, form a list unequalled in the annals of nobility by any land. There are together thirty-one species of Falconidæ, and of vultures, four. The eagles appear to be all common; among them the most magnificent birds of prey, the imperial and golden species. How the flight of these creatures, soaring alike over the crags of Carmel or stagnant Dead Sea, or the towers of Jerusalem, calls to mind the spirits that have so often in this land pierced beyond the clouds of darkness of heart and bonds of human grovelling, and risen to contemplation of that glorious and all-powerful One, who created alike the mountain and the eagle.

To the ornithologist, acquainted with the fauna of North America, it will thus be readily perceived, that, in comparison, the bird-fauna just examined possesses more numerous representatives of the higher groups of the birds, and among lower groups, possess chiefly those of superior grade, or lacks them altogether. Let us, however, compare it with

that of another region, where varied surface and temperature offer even greater opportunity for variety within quite as restricted an area.

One of our early lessons that has to be unlearned is to the effect, that North and South America are separated by the Isthmus of Darien. This is in consequence of our natural later inquiry, Does this close approach of the two mighty oceans restrict the distribution of organized beings from region to region, or is it but a passage-way for the multitudes of the one side, into the far domains of the other? We can ask farther: Can such a narrow area support a variety of active existences? And again, in the cosmical view, Where in the scale of time's revelations do these beings stand? are they developments of the latest and newest creation? or have they any kin among those that are passing away?

The opening of the Aspinwall and Panama Railway has given us many a view into this forest-covered mountainous region. The vigor of the vegetable world presents a barrier to extended examination, little seen in more northern climes; hence less will meet the eye of the passing traveller than in a trip over an equal stretch of highway in the United States or Europe.

To those persons who with knife in hand have hewn their way through the Agaves that transfix the flesh, and the creepers that trip the feet, a world of life has been found; and this restricted region has been ascertained to abound with the forms which one would only expect to gather in a favored spot of some great continent. That nature can long hide from the eye of man will be evident, in view of the fact, that one of America's largest mammals, a beast related to the common tapir, has only come to light within a few months. I allude to the *Tapirus Bairdii.*

The bird-fauna has been found by Messrs. Sclater and Salvin to embrace about 385 species, which is sixty-three more than were mentioned to occur in Palestine, which is open on three sides to the great continent. Of these but

thirty-seven are water birds, Natatores and aquatic Cursores, showing that it is not the ocean that yields the abundance here. Of the 348 land birds, forty-four are characteristic of, or occur in North America, exclusive of Mexico, and 290 are of South American kin. We need not then hesitate to refer this region to the latter fauna, especially as we know many of the same species to be to some extent dwellers in Mexico. On this and other grounds we may safely add the thirty-six species which range from Mexico to the Isthmus as their *ultima thule* southward, to the evidence that this region is far within the frontiers of the Regio Neotropica.* Eighty of the 348 are familiar rangers of Central America, which have not spread farther towards the fields of the Montezumas; and those which find their kin limited to the Isthmus and adjoining regions of New Grenada and Equador, amount to about seventy-five more. Twenty-seven is the number not known to extend beyond the boundaries of Palestine; as to the Middle States of our Union, not one species has been shown to be restricted within such narrow limits.

A single species occurs in Europe; this is the fish-hawk, an animal which combines the cosmopolite habit of the sea-bird with the powerful flight of the bird of prey. This is also the only species common to the Panama and Palestine catalogues.

The birds of prey are numerous—twenty-nine species. Among these there is no true eagle or falcon, and of the nineteen genera, but four belong to the fauna of the Holy Land. There is but one species to represent the great grouse family, but instead, three *families* of their South American imitators, the Pullastræ, instead of the one, that of the pigeons, slimly represented in Palestine, and in North America as well. These Pullastræ are a generalized group, combining features of the perchers with those of the Rasores.

*One of the six great zoölogical regions of the earth, including South America, West Indies, and Mexico.

The Curassows are their largest modern type, while the Dodo represents our knowledge of the extinct forms.

The group of Struthions is also well represented by the various Tinamus. One of this group—the true ostrich—wanders over the borders of Palestine, but is scarcely an "Autachthon." He stands lower than the Tinamu.

Coming to the closer test of superiority, the Passeres,—those delicate creatures apparently so dependent on those laws which govern increase and provision, and so affected by the changes that man works in the face of nature; what do we find? Of the Clamatores, who least tune their voice to nature's harmonies, but rather imitate the fierce tones of the cruel, or the wild cries of the dwellers in the shades, we count 106 distinct species. There are none in Palestine. Of songsters, the Oscines, ninety-six species, await man's conquest of the wilderness to increase in numbers and to display their gifts, while Palestine rejoices in a whole army of them. But the contrast is remarkable if we analyze these forms. Of the Isthmus Oscines, seventeen only hold the first rank by virtue of their additional (the tenth primary) quill, while this feature marks 128 species of Palestine. As we rapidly follow the line to the point where its extreme is manifested, in the family of the thrushes, or Turdidæ, Panama is left but two solitary pioneers of these songsters of the north, while seventy-five species represent the family in Palestine.

We naturally inquire, Is there anything in the food, the vegetation, or the temperature, to account for this apparent diversity? Are there not seed-eaters, insectivores, and tree-climbers, where seeds and insects and forests grow the world over? We answer, undoubtedly there are, and these adaptations to food and climate are indeed as nothing in the general plan of creation, for every type of every age has performed these functions successively. Those which fill these places in the Isthmian and general neotropical bird-fauna, are the Clamatores already alluded to. Let us compare these with the Oscines, and see how complete is the parallel.

Clamatores.		Oscines.
I. Tree-climbers with long hind-toe and tail feathers stiffened.		
Dendrocolaptidæ.		*Certhiidæ.*
II. Tree-perchers with hooked bill, graduating from powerful to medium and slender.		
Formicariidæ.		*Turdidæ.*
Thamnophilus,	bill strongest,	*Lanius,**
Formicarius,	" moderate,	*Turdus,*†
Formicivora,	" weak,	*Sylvia,*‡
Rhamphocænus,	" slender (wren's),	*Troglodytes.*§
III. Fly-catchers with flat bill and weak legs; wait for their prey and take it on the wing.		
Tyrannidæ.		*Muscicapidæ.*
IV. Flat-billed berry and fruit eaters.		
Cotingidæ.		*Bombycillidæ.*

So the subject might be pursued as it has been by others, and many parallels in greater details be drawn. Suffice it to say, that the same can be done for the frogs, the tortoises, the saurians, and to a great extent for the fishes of this same great fauna.

Now whether we call these types lower or higher, we find them to have spread in former ages over a far greater area of the earth's surface than at present. The writer has ascertained that many of the turtles of the Eastern Cretaceous period of our country are of this peculiar neotropical group, and that the species of the Eocene period of England (*Platemys Bowerbankii* and *Emys lævis*) really belong to the family Podocremididæ, now only known in the Amazon Basin. Another (*Platemys Bullockii* ||) really belongs to another family of the same series, the Sternothæridæ, now only known in Africa.

This brings us to another point. The whole Southern Hemisphere shares in the peculiarities of the South American or Neotropical fauna. Australia possesses a strange mixture of the old and the new; the clouds of the past floating in the sunlight of the future. South America, with newer mammals, has older reptiles, while to Africa comparatively few of the ancient landmarks remain.

*Butcher-birds. †Thrushes. ‡Warblers. §Wrens.

|| Type of the genus *Digerrhum* Cope.

That these characteristics of the fauna mentioned are, in comparison with others, really successional, in the same manner as are different geologic epochs in relation to each other, can be proven by the study of the anatomy and development of the species of each. Their relative greater or less extension during the periods of geologic time also furnishes an indication of a chronic relation now existing between these faunæ. Thus we have before us some of the terms of that grand proposition, whose demonstration must ever be of high interest to mankind.

THE CHASMS OF THE COLORADO.

BY A. HYATT.

In Niagara we readily realize the power of demolition attributed to its waters. The Fall is still receding, the ground is shaken under us by its blows, the chasm it has cut yawns before our eyes. But it is another and far different matter to recognize the same force in other localities, where, perhaps, a puny stream, depleted by the summer heats, trails along the centre of some deep gorge.

Here the observer must remember that time has no boundaries in geology; that existing causes, provided they are capable of carrying away ever so small a portion of solid earth and rock now, would, in ages past, have had opportunity enough to have destroyed the whole of the rocky core which once filled the ravine.

Let him descend and look at the tottering pinnacles threatening him from above, and then examine those that have already fallen. The layers of the shattered masses are open to the ice-wedges in winter, the grinding and transporting power of the spring freshets, the alternate heat of noon and cold of night. Acted upon also by the oxygen of the air,

the acids in the water now dry, now wet, is it a wonder that they are covered by a coat softer than the interior of the rock, which is readily ground off or dissolved by the stream? The rusty coating of iron arises from the same causes, and yields in the same way when exposed to similar influences, until the hard metal has entirely disappeared.

The lofty ledges themselves are constantly crumbling, the finer dust swept away by the winds, and the heavier pieces plunging to the bottom. Every rain carries away, in solution, the dust which the winds have spared, and a portion of the softened outer-coatings of the stones.

Watch the bottom of any fast-running rivulet, you will see a moving cloud of the finest particles, and under them larger pieces rolling confusedly onwards. The larger pieces are slowly but surely wearing themselves away, and the moving cloud is the result of this grinding. Thus it is that nearly all the stones found in brooks are pebbles. When first broken away from the parent rock they must have had sharp edges like any other fragment. Have you never found a piece of a bottle in the bed of a stream, with the edges nicely smoothed, and the sides scratched and scored like ground glass? They are quite common, and show how pebbles are made with perfect accuracy.

Quietly and almost imperceptibly the tireless waters work, except when heavy rains or spring freshets, muddy and discolored with their burden of dust and dissolved rock, move even large boulders and destroy well-known landmarks. The ability of water to handle rocks of any size, provided it is deep enough and swift enough, is unquestioned. In the Au Sable River, where the inclination of the shelving rock which formed the bed was not over two or three degrees, or the depth more than eighteen inches, I have myself, by the aid of a lever, rolled into the current great pieces of sandstone, three or four feet long and a foot thick, and heard their heavy rumbling over the ledge as they were carried away. Among the shales, limestones, and sandstones, ra-

CHIMNEY PEAK.

vines of this description are common; and in these sedimentary rocks where layer answers to layer on either side of the gorge, there can be but little doubt that water has carved them out. In the more disturbed localities, however, where the stratification is obscured, it becomes difficult to determine whether the chasms were not originally great cracks in the earth, subsequently enlarged by the grinding and transporting power of the stream. The Colorado of the West affords the best illustrations of these two kinds which have yet been seen by man. In its lower part the rocky sides of the cañons are cut out of strata highly inclined and disturbed, where they have been bent upward to form the mountains, while in its upper portion they are perfectly horizontal.

Two rivers, the Green and the Grand, rise at the western bases of the Rocky Mountains, ten or twelve thousand feet above the sea, one in South-western Nebraska, the other in South-eastern Oregon, and are said to unite their streams near the southern boundary of Utah, to form the Colorado of the West. This then flows south-westerly, and empties into the Gulf of California. The descent is accomplished at first by a grand cañon cut through a succession of elevated plateaux, called Mesas, which spread out westward from the base of the Rocky Mountains, like a gigantic stairway, each step a thousand feet or so in height and many miles in breadth, and in its lower part by a series of cañons through ranges of mountains.

Plate 7* shows the north-western prolongation of the Purple Hills, which form the first three cañons in the river. The two pinnacles of "Chimney Peak," looming up in the background, are composed of trap. This being much harder than the material of the neighboring rocks has yielded less to the action of the elements, and shows how vast has been the denudation which has destroyed them. Professor Newberry estimates that in some cases the wearing away of the moun-

*From the Editors of the American Journal of Arts and Sciences.

tain masses has been upon such a grand scale, that now they are only half their original size.

The Mojave cañon, the fourth or fifth through which one passes in ascending the river, is described by Lieutenant Ives as follows: "A low, purple gateway, and a splendid corridor with massive red walls, formed the entrance to the cañon. At the head of this avenue, frowning mountains, piled one above the other, seemed to block the way. A sharp turn at the base of the apparent barrier revealed a cavern-like approach to the profound chasm beyond. A scene of such imposing grandeur, as that which now presented itself, I have never before witnessed. On either side majestic cliffs, hundreds of feet in height, rise perpendicularly from the water. As the river wound through the narrow inclosure, every turn developed some sublime effect or startling novelty in the view. Brilliant tints of purple, green, brown, red, and white, illuminated the stupendous surfaces and relieved their sombre monotony. Far above, clear and distinct upon the narrow strip of sky, turrets, spires, jagged, statue-like peaks and grotesque pinnacles overlooked the deep abyss."

To this succeeds the Painted Cañon, whose exquisitely tinted walls, though less grand, seem to have excited the artistic taste of the explorers not less than the Mojave Cañon. Then occurs the Black Cañon, where, for twenty-five miles, the narrow river plunges through the sunless depths of the Black Mountains, the precipices on either side rising perpendicularly a thousand feet or more from the water. The little band, in their frail boat, were buried in this fearful gorge for two days, and one follows them through the difficulties and dangers of the pass with breathless interest.

The walls of these cañons, according to Dr. Newberry, the geologist of the expedition, are formed of great masses of granite, porphyry, trap, and other volcanic rocks, with layers of highly crystalline limestone and conglomerates, which are of equal heights, and correspond exactly on either

side of the river. The unavoidable inference from these facts is that the mountain ranges, of which there are several besides those I have mentioned, once crossed the bed of the river and dammed back its flow, filling the valleys between with extensive lakes. These were probably connected by a series of cascades and rapids, which must have been of unparalleled beauty and grandeur; but as Niagara is destroying itself, so have they destroyed themselves. The stupendous precipices, so graphically described by Lieutenant Ives, are the trophies of their unconquerable power, the remnants of those mountain barriers through which the cataracts ate their way and drained the great lakes of the interior.

These chasms, however, with their thousand feet or so of granite and solid porphyries, are but the outer gates preparing the mind for the awful sublimity of the Great Cañon. The local disturbances or oscillations which gave rise to the wild scenery of the lowlands, tossing their originally horizontal layers into lofty mountainous waves, have made no impression upon its walls. The level courses of sandstone, limestone, and shale, lie upon a bed of granite, of itself a thousand feet thick, without a bend or fault to mar their perfect parallelism. The entire thickness of the first great Mesa or plateau, west of the Rocky Mountains, is exposed in the cliffs, and the edges of the severed plain hang in the air over a mile above the river.

"The scenery," says Lieutenant Ives, speaking of a side cañon down which they passed some seventeen miles to the river, "much resembled that in the Black Cañon, excepting that the rapid descent, the increasing magnitude of the colossal piles that blocked the end of the vista, and the corresponding depth and gloom of the gaping chasms into which we were plunging, imparted an unearthly character to a way which might have resembled the portals of the infernal regions." No attempt is made to describe the Great Cañon itself. The explorers seem to have succumbed to the awe created in their own minds, and yielded the greatest homage

they could have paid to the unearthly nature of the scene—silence. For three hundred miles the precipitous walls vary from three thousand to six thousand feet in height, and on every side the plain is furrowed by the tributaries, so that "fissures, so profound the eye cannot penetrate their gloomy depths, are separated by walls whose thickness one can almost span, and slender spires that seem tottering upon their bases, shoot up thousands of feet from the vaults below."

The country is impassable to man and beast, and none but birds can explore the cavernous abysses. The solitude is unbroken, and the inhospitable rocks deserted, save by a few Indians who drag out a wretched and monotonous existence among the subterranean passages. No vegetation clings to the sides of the cañon or covers the broken surface of the Mesa; all is alike naked and savage.*

The chasm at Niagara excites much wonder, but what shall be said of this? The horizontal strata, answering layer to layer upon either side, are witnesses that cannot lie. If this three hundred miles of solid earth had been torn apart by volcanic forces, the strata would not now be horizontal, but contorted or bent upward. Had one part settled away from the other, leaving a gap between, the strata would not be at equal heights. The river is the only agent that could have done the mighty work. At some period of past time incalculably distant, the Colorado and its tributaries flowed over a mile above on the Mesa, and descended by a cascade into a great lake which filled the valley between the Great and the Black Cañons. A succession of such lakes, connected by cataracts or rapids as before described, led over the mountain chains, until step by step it reached the valley through which it now flows to the Gulf of California.

Newberry found, in the deposits of the lower part of the river, the tooth of a mastodon and the silicified remains of

* Plate 8, for which we also are indebted to the kindness of the Editors of the American Journal of Arts and Sciences, gives a view of the general aspect of the surface, with other Mesas rising in the distance.

THE CHASM.

fossil drift-wood buried in the ancient banks now some two hundred feet above the present level. These remains indicate a far more abundant vegetation than at present, and that when the lakes spread their broad sheets over the now barren valleys, and the rivers were near the surface of the Mesa, all the land was covered by great forests of pine, among which huge elephants roamed and cropped the succulent leaves. Time has sapped this green, luxuriant youthfulness, and in its seared and wrinkled old age, though grander and more majestic, the country is bald and unfruitful.

THE RUFFED GROUSE.

BY AUGUSTUS FOWLER.

This beautiful bird, the *Bonasa umbella*, is a resident in Massachusetts. It commences breeding very early in the season, so early indeed, that the nest and birds are frequently covered with the late snows.

It is at this time of the year, more than at any other, that the male practices the peculiar habit of drumming, to call his mate. He usually selects for the purpose the trunk of some fallen tree, and, mounting it, struts back and forth, with tail expanded and head thrown back and wings lowered till they drag upon the log. These are the preliminary movements. Suddenly he stops, throws his head forward, lowers his tail, compresses his feathers, and then commences to strike his sides with his wings, increasing the rapidity of the strokes, until the sound produced resembles low distant thunder.

They build their nest on the ground, in some secluded place, under a brush-heap, or by a log or fallen fence. It is composed of whatever suitable materials lie about the spot, such as dried grass, twigs, and dried leaves. After the

female commences laying she lays every day, until towards the last end of the litter, when she lays every other day, until she has laid ten, twelve, and sometimes fifteen eggs. These she places around the nest in circles, that each may receive an equal degree of warmth while she is sitting upon them. When she leaves them, she sometimes covers them with grass or leaves, but not always.

The inside of the nest measures five and a half inches, its depth two and a half inches. The color of the eggs is yellowish-white, marked with reddish-brown spots. Usually the last ones of the litter are without spots, and of a lighter color, a few larger round spots appear to be laid on the surface of the shell and raised above it. Sometimes a nest of the Ruffed Grouse is found to contain a litter of pure white eggs. This difference in the color of the eggs may arise in consequence of the first nest of the bird being destroyed. In connection with this I will mention an instance of a blue-bird that was robbed of her eggs in succession, until she produced pure white ones. Her first litter was taken in April, whereupon she immediately laid another litter of a lighter color than the first. These being taken, she laid another litter of four eggs, of a still lighter color than the second. This third litter was also taken from her, when she laid one more of three eggs, entirely white. The Marsh-hawk lays from six to eight eggs for the first litter, which are all distinctly marked, with the exception of one or two that are laid last. If this first litter is destroyed and she lays again soon, the eggs will hardly have a perceptible spot upon them. For this reason no birds' eggs should be described, or preserved as typical specimens, except those laid first in the season.

When the female Grouse begins to sit, the male forsakes her and rambles about alone, or in company with other males, until autumn. Then he returns, and the birds keep together till the following spring, when they separate in pairs to breed.

Under different circumstances the female uses different artifices to preserve her young. If she sees a person approaching, and cannot lead her young brood away before she suffers the intruder to come too near, she utters a low clucking note, and in an instant every chick is hid, and will remain so until called by her; while she, in the mean time, walks slowly away, keeping her eye fixed on the intruder, and occasionally stopping and standing on one leg. If you still advance, she walks as before, appearing as though there was nothing very interesting about the place, until she gets behind a tree or bush, when the whirring of her wings tells that she has flown away. Many a person has been led away by this manœuvre, while she returns by a circuitous route to the rear, and alighting near her young, calls them to her. When suddenly alarmed, the brood as before hide under the leaves and rubbish, while she feigns lameness, and if not followed, usually returns bristling her feathers and fluttering about. And if your foot is presented to her, she will strike at it in the same manner as a domestic hen when defending her chickens. The young follow their mother from the day they are hatched until they are fully grown, and even until the following spring.

So ardently is this beautiful game-bird sought for, that many are destroyed every year, not only with the gun, but by every contrivance of snare and trap; and by the last two methods whole broods are taken before they have reached maturity. If such indiscriminate slaughter should continue for a few years to come as in times past, we shall have cause to regret that effective measures were not taken for the preservation of this noble bird.

The Ruffed Grouse is born to be free, and if reduced to slavery, will die rather than submit to such degradation. He scorns to be a domestic bird, and chooses the wild forests, where, with a proud step and erect head, he walks with that haughty bearing which indicates his free spirit.

A TROPICAL AIR-PLANT.

BY CHARLES WRIGHT.

A WONDERFUL tree—if tree it can be called—grows throughout the West India Islands, in South America as far south as Brazil, and perhaps in Florida. It is not remarkable for its beauty, nor for its great size, but for its irresistible power of destroying other trees.

It is an epiphyte (*Clusia rosea* Linn.), perhaps a true parasite. Whether it ever germinates in the ground I know not; nor do I know why it should not, if it can sprout from a woodpecker's hole in a palm. Certain it is, that of hundreds which I have seen, I never saw a young plant attached to the soil. It grows on many kinds of trees, and at almost any height above the earth. In some situations it grows feebly. On a palm, it never or rarely attains to any considerable size; whether there is an incompatibility between the two growths, or whether, as is commonly the case on these trees, it germinates at too great a height. On the spreading branch of a tree it thrives better, but seems there to be not in its proper place. In any case, its main development is downward. When on a branch remote from the trunk, the descending axis—root or trunk, whichever it may be—is like a cord, increasing to the size of a rope, or a hawser, or growing even larger; rarely branching, but, sometimes, near the ground sending off stays. The ascending axis makes little more than a bush, while the root may be thirty or forty feet long. In one respect, this is like a true root,—it branches irregularly,—while, on the ascending trunk the leaves and branches are in pairs.

In order to attain its full development, it seems necessary that it should germinate at a point from which the descending axis shall pass in proximity to the trunk of the tree, and, it has seemed, that if this point be very high, it is a circumstance unfavorable to its rapid growth.

Supposing, then, our plant to start under favorable auspices, not very high above the ground, and from a hole or a fissure in an erect trunk, the ascending stem presents nothing of special interest, but the root, passing down near the foster-tree, is most singularly affected by it. It would seem as if possessed of a most grateful affection for that which gives it support; so much so, as to multiply arms with which to embrace it. It sends off, from time to time, at irregular distances, from one side or the other, slender, almost thread-like branches, which pass horizontally around the tree, till they meet on the opposite side and unite; or, it may be, if two should *not* meet, they would pass entirely round it and unite again with the main root. On this point, I either made no careful observations, or my memory is at fault. Gradually the foster-tree is embraced by a succession of these cords. But, by the same regular growth, these cords spread upward and downward, till they become hoops. And these hoops often send off branches from one to another; and these in their turn widen, till the tree is inclosed in a living cylinder or a cylindrical network of bands, having immense strength; and as these seem to increase only laterally, the growth of the tree is checked, and its destruction is inevitable, sooner or later, according to its less or greater power of endurance.

A tree, on which the Copey has woven a pretty complete net, cannot long retain its vitality. Its circulation is stopped and it dies. But this *seems* not to check the growth of the destroyer, so long as the trunk remains erect. But when they both fall, the parasite cannot long survive. It would seem that it required either elevation or an erect position for its existence.

I can recall to mind but one instance of a Copey growing from the ground, and it is probable that in this case the place whence it started was low, and it had time to reach the soil and fasten its roots there before the death and decay of its foster-parent.

Copey is, probably, the aboriginal or Carib name of the plant, which, like many others, has been retained. Scotch lawyer, or Scotch attorney, by which name it is known in Jamaica, is not altogether flattering to legal gentlemen of Caledonian extraction.

THE MOTTLED OWL.

BY DR. W. WOOD.

Of the genus *Scops*, there are some twenty-five or thirty species in all parts of the globe, only one of which, according to Cassin, is found in New England. From the time of Pennant till they were separated by the Prince of Canino (Charles Lucien Bonaparte), the mottled (*Strix Asio*) and the red owl (*Strix Nævia*) were considered two distinct species: since that time, the writers on ornithology—so far as I have been able to learn—consider them the same bird. Some, and probably the most, believe that the mottled is the adult, and the red the young, while others are equally sanguine that the reverse is true. Brewer, in his synopsis of the birds of North America, says that the red-plumaged bird is the adult. In his opinion he is sustained by Doctor Cabot, of Boston, and many other distinguished naturalists. Audubon says, "The red owl of Wilson and other naturalists is merely the young of the bird called by the same authors the mottled owl." Cassin, in the Pacific Railroad Report (vol. ix, p. 52), agrees with Audubon, yet says "the two stages of plumage described above (adult and young) have been regarded as characterizing distinct species, and they do present a problem scarcely to be considered as fully solved." And furthermore he says, "this bird pairs and rears young while in the red plumage, and it is not unusual to find a mottled male and red female associated or the reverse." While Audubon says, "By the middle of August they are

fully feathered, and are then generally of the color exhibited in the plate (red). The feathers change their color as the pairing season advances, and in the first spring the bird is in perfect dress (gray)." How, then, can a gray and red pair, as the young never pair until the following spring? From the above quotations you perceive that there is a great difference among scientific ornithologists as to which is the adult and which is the young;—and, if it will not seem egotistical, allow me to say that I believe all are right and all are wrong; for, according to my investigations, there is an adult red and an adult gray, and also a young red and a young gray. As "the truth, the whole truth, and nothing but the truth" is or should be the only desideratum known among naturalists, I propose to give my experience and observations, hoping to elucidate the subject somewhat, intending still to prosecute my researches until the identity or non-identity is settled beyond dispute. A writer in the transactions of the Academy of Sciences of Philadelphia, vol. 8, p. 53, expresses my views on the subject. He says that "the color of both young and old is variable and uncertain, or else they are specifically distinct, having observed both the old and young of the Mottled-gray Owl, neither of which had the slightest shade of red about them;" and I can add, that I have not only observed the same, but also the adult Red on her nest with red young. In my collection is a Mottled Owl that was taken from her nest in a hollow tree that she had occupied several years with one of her young, neither of which had a red feather on them. I have also a Red Owl that was taken from her nest by a farmer who informed me that she had nested close by his house in the same hollow tree four or five years, and that he had been in the habit of taking her out and showing her to his friends, but having a brood of chickens disappear suddenly, he supposed this owl was the thief. In answer to my interrogations, he said she had always the same red color. In the spring of 1860, I found a Red Owl on her nest with four

young under her: the latter were quite young, yet had the reddish tinge wherever the down was superseded by feathers. I stuffed one of them and kept the other three four months, when it was difficult to distinguish them from the adult bird. From the above it is evident that there are two adults, at least from three to five years old, the one red without a gray feather; the other gray without the slightest shade of red; also, the young of each before they could fly, one pure gray and white without a red feather, the other with a reddish tinge to all the feathers. These facts I am unable to reconcile unless it is admitted that the color of the plumage is either "variable and uncertain," or else, that there are two distinct species as described by Wilson in his American Ornithology.

In the fall of 1860 I wrote to my friend, Dr. S. W. Wilson, St. Simon's Island, Geo., who is an experienced ornithologist, and who has an extensive aviary, relating my investigations, and soliciting his observations as to the identity or non-identity of the Mottled and Red Owls, and received the following reply: "I will as far as I am able dispose of the Owl question. I feel that I can speak almost authoritatively in the matter from the number of observations I have made of each species. Fortunately, both the species to which you refer are abundant here, and I have no hesitation in saying that Wilson described them accurately, and subsequent naturalists have erred in considering them under one species. I have observed the old owls of each species feeding their young, noticed the change of plumage in the latter, and have on many occasions taken them from a hollow to secure their eggs, and have invariably found one species red, the other gray."

As the habits, manner of nesting, and appearance of the eggs are the same in both stages of plumage, or in the two species, the same general description will suffice for one or both. The Little Screech-owl, as it is commonly called, is found more or less numerous in all parts of the United

States, and extends its migration as far north as Greenland. In the States on the Atlantic coast, it is more numerous than any of the family Strigidæ. Although this species is not considered by many ornithologists migratory, yet from my own observations I believe that most of them leave us in the winter; for while they are frequently taken here during the spring, summer, and fall months, they are seldom found in the winter. Wilson considered the Mottled Owl a native of the northern regions, extending its migrations as far south as Pennsylvania in winter, yet the Red Owl he believes is not migratory.

It is said that its power of vision is so imperfect that it will suffer itself sometimes to be taken in the hand when found away from its retreat in a clear day. That it can be taken in that way I know by experience, yet it does not necessarily follow that it is owing to defective vision. Like the preceding owl, it can see tolerably well at noonday. One that I let loose in my office flew against the window with such force as to break the glass, through which he escaped, and alighted on the limb of a tree some twenty rods distant, as readily as any bird could. Seeing me coming with a gun, he flew into a dove-hole in the barn. This occurred in the middle of the day, when the sun was shining clearly. Another that I kept in a cage would greedily seize his meat in broad daylight, and eye me closely when approaching with his morsel, snapping its bill after the manner of owls. Three that I tamed would come at call any time of the day from their perch in the barn. The probability is, that the owl, previously to being taken by hand, has gorged itself with food until unable to fly to its hiding-place, and thus remains almost stupid during the day. The hawk will sometimes gluttonize itself so that you can approach very near it before it will attempt to fly. The Screech-owl, like all nocturnal birds of prey, mostly secures its food at twilight, and the bird that has sat with eyes half-closed and head drawn down as though asleep during the day, is now active and vigilant,

catching its game, which consists of small birds, mice, crickets, beetles, and other insects. These are swallowed mostly whole, and afterwards the bones, feathers, hairs, etc., are ejected in the form of pellets. As a caterer this harmless little owl is not excelled by any of its genus.

It is difficult to describe the cry of this bird; sometimes it sounds like a child crying, then again like the syllable hŏ-hŏ-hŏ-hŏ-hŏ-hŏ-hŏ-hŏ in quick succession with the quivering sound, or as Wilson admirably describes it: "It reminds one of the shivering moanings of a half frozen puppy. These notes you hear in the spring during pairing season, and also when the young have recently left the nest. They are generally answered by the mate or by the young. Last spring meeting one of my neighbors in the morning he inquired if my child was sick? I replied in the negative, and asked him why he thought so? He said 'I heard a child cry almost all night, and it appeared to come from your house!' Soon another accosted me like the first, and he was positive that the crying came from the same source. The mystery was soon explained when I informed them that a young Screech-owl was the sole occupant of a box eight inches square under my waggon-seat. By the superstitious, this wailing cry about the house is considered the forerunner of death. On visiting one of my patients I found the mother in tears, wringing her hands and moaning piteously, when she informed me that her child must die, for an owl had been near the window and cried almost all night. I endeavored to pacify the good lady by assuring her that her child would recover, but all to no purpose, for she believed the owl was a sure messenger of death, and no earthly power could avert it. The child recovered, and although seven years have elapsed, no member has yet obeyed the summons of the owl, yet the superstitious dame is hourly expecting that some one must go soon."

One of the Latin poets, in alluding to the cry of the owl says,—

"Est illis strigibus nomen; sed nominis hujus
Causa quod horrenda stridere nocte solent."

But I can say, in the language of Cowper,—

> "The jay, the pie, and e'en the boding owl,
> That hails the rising moon, have charms for me:
> Sounds inharmonious in themselves and harsh,
> Yet heard in scenes where peace forever reigns,
> And only these, please highly for their sake."

The Screech-owl breeds in hollow trees, more commonly the apple tree, often but a few feet from the ground. Their nest is composed of grass, leaves, and feathers, and contains from four to six white eggs, nearly round. There is no apparent difference in the eggs of the Red and Mottled Owl. Wishing to obtain the eggs of the Red Owl, I requested a friend to secure me some from a nest that had been occupied by the same pair for years. Thrusting his hand into the hole, he withdrew it again in a hurry. In looking into the aperture, the eyes and ears of an owl were quite apparent, but the feathers were fur. The occupant proved to be Mrs. Puss, with her family of four kittens. This is the second instance of the kind that has come to my knowledge, and no doubt the modus operandi by which this transformation occurs can be easily explained by the superstitious, as did the ancients the metamorphosing of Jupiter into a bull.

[This article was received May 16th, and put in type before Mr. Allen's "Notes," given in the August number, were received.—EDITORS.]

REVIEWS.

THE POPULAR SCIENCE REVIEW, in the July number, contains a lecture by Professor Huxley "On the Animals which are most nearly intermediate between Birds and Reptiles." Such connecting links do not now exist, but the lecturer finds traces of such links in the fossil *Iguanodon*, and other Dinosaurians, in the Pterodactyle, and especially in the feathered reptile-like bird, *Archæopteryx*, of the Oölite formation; and in the animals, some bird-like, others reptile-like, which lived during the Triassic period in the Connecticut Valley.

I have now, I hope, redeemed my promise to show that, in times past, birds more like reptiles than any now living, and reptiles more like birds than any now living, did really exist. But, on the mere doctrine of chances, it would be the height of improbability that the couple

of skeletons, each unique of its kind, which have been preserved in those comparatively small beds of Solenhofen slate, which record the life of a fraction of Mesozoic time, should be the relics, the one of the most reptilian of birds, and the other of the most ornithic of reptiles. And this conclusion acquires a far greater force when we reflect upon that wonderful evidence of the life of the Triassic age, which is afforded us by the sandstones of Connecticut. It is true that these have yielded neither feathers nor bones; but the creatures which traversed them when they were the sandy beaches of a quiet sea or lake, have left innumerable tracks which are full of instructive suggestion. Many of these tracks are wholly indistinguishable from those of modern birds in form and size; others are gigantic three-toed impressions, like those of the Weald of our own country; others are more like the marks left by existing reptiles or *Amphibia*. The important truth which these tracks reveal is, that, at the commencement of the Mesozoic epoch, bipedal animals existed which had the feet of birds, and walked in the same erect or semi-erect fashion. These bipeds were either birds or reptiles, or more properly both; and it can hardly be doubted that a lithographic slate of Triassic age would yield birds so much more reptilian than *Archæopteryx*, and reptiles so much more ornithic than *Compsognathus*, as to obliterate completely the gap which they still leave between reptiles and birds.

But if, on tracing the forms of animal life back in time, we meet, as a matter of fact, with reptiles which depart from the general type to become bird-like, until it is by no means difficult to imagine a creature completely intermediate between *Dromæus* and *Compsognathus*, surely there is nothing very wild or illegitimate in the hypothesis that the *phylum*, or genealogical tree, of the class *Aves* has its root in the Dinosaurian reptiles; that these, passing through a series of such modifications as are exhibited in one of their phases by *Compsognathus*, have given rise to the *Ratitæ*; while the Carinatæ are still farther modifications and differentiations of these last, attaining their highest specialization in the existing world in the Penguins, the Cormorants, the Birds of Prey, the Parrots, and the Song-birds.

However, as many completely differentiated birds in all probability existed even in the Triassic epoch, and as we possess hardly any knowledge of the terrestrial reptiles of that period, it may be regarded as certain that we have no knowledge of the animals which linked Reptiles and Birds together historically and genetically; and that the *Dinosauria*, with *Compsognathus*, *Archæopteryx*, and the Struthious Birds, only help us to form a reasonable conception of what these intermediate forms may have been.

In conclusion, I think I have shown cause for the assertion that the facts of Palæontology, so far as Birds and Reptiles are concerned, are not opposed to the doctrine of Evolution, but, on the contrary, are quite such as that doctrine would lead us to expect; for they enable us to form a conception of the manner in which Birds may have been evolved from Reptiles, and thereby justify us in maintaining the superiority of the hypothesis, that Birds have been so originated, to all hypotheses which are devoid of an equivalent basis of fact.

M. Sanson thinks there are in the East two species of horse, which have hitherto been confounded under the single name of Arab.—Starch granules have been found by M. C. Dareste in eggs. This fact, says M. Dareste, adds to the analogy which is thought to exist between the egg of animals and the seed of plants.—The old stock illustration of the force of food in producing peculiarities of animal structure, namely, that of the production of sex in the bee, by the supply of a particular form of nourishment, has received a death-blow in the researches of M. Sanson. In a paper quite recently published, he narrates numerous experiments which prove beyond question that the food has nothing special to do with the production of sex, which, in point of fact, as worked out by Herr Bastian, depends on the supply of zoösperms.

A Guide to the Study of Insects. *By A. S. Packard, jr., M. D.*—Part II. contains chapters on the metamorphoses of insects, their geographical and geological distribution; directions for collecting and preserving insects; a list of the most important entomological works, and a general account of the Hymenoptera, and of the Honey-bee and its mode of building its cells. It consists of 68 pages, with two plates and illus-

trations in the text. It is hoped that it will prove a valuable number to those beginning to study insects. Part III, to be issued in September, will contain chapters on the Wild Bees, Wasps, Ants, and other Hymenoptera, with three full-page illustrations and numerous cuts.

As there has been some misunderstanding regarding the price of the work and the number of parts to be issued, and how they should be paid for, we would state that it will be issued in from eight to ten parts, probably ten, of sixty-four pages each, and it would be a great convenience to the publishers if subscribers would send $4.00, *in advance*, for the first eight numbers. Address the author at Salem, Mass.

NATURAL HISTORY MISCELLANY.

ZOÖLOGY.

A Review of some of the Articles published in this Journal respecting the Habits and Nesting of our Birds, with Additional Facts.—The oölogical department of ornithology affords ample scope for the most enthusiastic observer to glean something new continually. Different localities and different circumstances modify very much the manner of nesting, as well as the number of eggs; in fact, eggs vary in color occasionally. In the first volume, page 435 of this Journal, Mr. Samuels speaks of several specimens of Indigo-birds' eggs "sprinkled with dots of pale-red." Of a large number of Indigo-birds' eggs, collected by myself and received from others during the last twenty years, they have invariably been white, with a bluish tinge, yet I have other eggs as singularly marked. I have full sets of Cooper's-hawks' eggs, without a blotch upon them, and others blotched with brown, and one set blotched with red. I have the eggs of the Blue-bird pure white, and polished like those of the family Picidæ (Woodpeckers). I have a set of four of the Red-shouldered Hawk's eggs, two of which are pure white, and two blotched with red, as they usually are. I have taken a set of four of crow's eggs this season that have no bluish tinge about them whatever. They are flesh-colored, blotched with red, resembling in markings the egg of the *Pipilo erythropthalmus* (Chewink). The changing of colored or spotted eggs to white is easily accounted for. The coloring matter is deposited on the shell in the oviduct, so that as a consequence of disease of the glands which furnish the coloring matter, the eggs may be laid uncolored. These are exceptions, not the rule, but of frequent occurrence enough to make us cautious and not too positive in our assertions. In no way can we get at all the facts, correct errors, and reconcile statements, unless each collector carefully observes, and truthfully gives his own experience in the various fields of pursuit.

In Vol. I, No. 7, p. 343, is a very interesting article on the Encampment of the Herons. As the writer differs in some particulars from my observations, I will give my experience. There has been an encampment of herons some sixteen miles from my office for many years, probably fifty, and perhaps one hundred. It has been there as long as any one remembers the place. I have been in the habit of visiting it for nearly twenty years. The tract on which they nest consists of very tall, slim trees, from sixty to ninety feet high, running up from thirty to fifty feet without a limb, and covering over a belt of ground one and a half miles in length by one-half mile in breadth. Before visiting the ground I sent there for two years in succession, offering a liberal reward to any one who would procure me some eggs. No one would venture, as the trees were in very wet ground, and in water, difficult to climb, and partly covered with the excrements of the birds. I was telling a sailor of my inability to get any one to climb the trees, when he roguishly inquired "if the trees were made of wood," remarking that "he could climb any tree made of wood." The next day found us in the swamp, and such a sight I never before saw. The woods were filled with the Quawks (*Nycticorax Gardenii*); there were thousands, and their noise was almost deafening on being disturbed, or, as Wilson graphically describes it, "it would almost induce one to suppose that two or three hundred Indians were choking or throttling each other." I counted eight nests on one tree, and many trees contained four and five. *Most of the nests were out on the limbs*, where it was very difficult to get at them; but there is no such thing as can't to a naturalist, when the prize is in view. A goodly number of eggs were obtained. Two years ago the past season I took with me three climbers, and secured a large supply of eggs. While returning we made a rough estimate of the distance climbed. As my cords for letting down the boxes of eggs were all measured, we could tell pretty accurately the height of the nests. They varied from fifty to eighty feet making an average of about sixty-five feet. One of my collectors, with creepers, climbed over twenty trees, which, in ascending and descending would make over half a mile, and that, too, in a rain storm, as it commenced storming soon after we arrived at the swamp and continued all day. This encampment is now nearly broken up, as a part of the trees have been cut off, and the sportsmen have wantonly shot the birds. Two hunters visited this place with a business waggon, and brought it back full of night-herons. There must have been between two and three hundred killed. This is the second heronry that I have been in the habit of visiting to replenish my oölogical collection from, and yet I have *never found over four eggs, and more commonly but three in a nest, and the nests were generally on limbs.* I mention these facts, not to throw doubt on the statements of Mr. Endicott, but to show that birds in different sections nest differently, and lay a greater or less number of eggs according to circumstances. I have sometimes thought that the birds were more prolific near the seashore where food is procured in such abundance.

In Vol. I. No. 9, p. 496, Mr. Samuels and Mr. Fowler disagree regarding the nesting of the Belted Kingfisher and Mottled Owl. My observations agree with both in some particulars, and disagree with both in other respects. I have been in the habit of collecting from one to three nests a year for fifteen or twenty years, of the *Ceryle Alcyon*. I take a light cane-pole about eight feet long and a spade with me, and follow down the banks of Scantic River in the nesting-season (middle of May to the first of June), and when I find a fresh hole, running horizontally, of suitable size and place for a Kingfisher, I carefully introduce the pole, ascertain the length of the hole, and by withdrawing the pole, and placing it on the top of the ground in the same line and distance introduced, the end of it will be exactly over the nest, as the nest is always at the extreme end. I then dig down upon it, going back upon the hole some six inches, so as not to break the eggs by the falling earth. In this way I get a fine view of the nest without disturbing it. In one instance the parent bird was so tenacious of her rights, that she allowed me to lift her from her nest. The nest is from eighteen inches to two feet under the surface, and generally *from four to six feet into the bank*. I never have found but one within three feet, and that was in a clay-bank. I have invariably found *the hole straight*, in whatever line it starts; if it starts to the right or left, *it follows that line, and so straight, that my pole reaches the end of the excavation without any trouble*. In stony ground, possibly, the bird may find it necessary to deviate from a straight line, but as we are not troubled with stones, I can only speak from experience in sandy soil. The eggs, usually *seven* in number, are *laid on the sand* in a small cavity made for them.

I can corroborate the statements of Mr. Samuels respecting the nesting of the Mottled Owl. "The nest is made at the bottom of the hole, and is constituted of grass, leaves, moss, and sometimes a few feathers. It is not elaborately made, being nothing more than a heap of soft materials." I cannot fully indorse the statement of Mr. Fowler "that rapacious birds are awkward workmen at nest-building, especially the owl." If Mr. F. had confined his remarks to the family of Strygidæ, all naturalists would agree with him, so far at least as pertains to the owls of New England. I can speak from observation of the Great-horned, Barred, Long-eared, Short-eared, and Mottled Owl. Of hawks I have collected nine varieties of eggs and nests, or young and nests in Connecticut,—the Fish, Red-tailed, Red-shouldered, Broad-winged, Cooper's, Sharp-shinned, Sparrow, Great-footed, and Marsh-hawk. All, with the exception of the last three, are good nest-builders. The Cooper's Hawk excels in the neatness and arrangement of her nest. It would puzzle a Yankee to do it any better out of the same materials. The Marsh-hawk makes a nest of small sticks and coarse grass, mostly the latter. I have found quite a number of their nests, and they appear like a promiscuous mixing together of material without any particular order or plan, any farther than to keep the eggs from the damp ground. I believe that they rebuild their old

nests sometimes, for I have one in my office which has the appearance of being occupied three seasons, with small additions each year. I know they will use the same nest more than once the same year if their eggs are taken. Some few years since one of my collectors came upon a nest of the Marsh-hawk and took the eggs. Some two weeks after he took five eggs more from the nest, and in a few days from that time he went to the nest and took two more eggs and shot the old bird, as she was altogether too familiar with his chickens.

In Vol. I, No. 11, p. 584, is a very truthful and life-like description of the Chicadee,—its habits, nesting, etc. The writer speaks of the habits of the Butcher-bird of killing it, and says, "if he does not devour it upon the spot, it is hung on the crotch of a limb to serve as a meal at some future time." I would like to ask Mr. Fowler if he knows that to be a fact from his own observations? Can any one give positive information upon the subject? I know this is received as a fact by most naturalists, and it may seem egotistical for me to doubt it, yet I have for years watched the *Collyrio borealis* from the time it arrives here in the fall until it goes north in the spring; have seen birds and grasshoppers suspended from a crotch or impaled on a thorn or sharp stick by them; but I never knew it return to devour them, although I have carefully watched for weeks. I think the bird does it for mere sport. It could hardly be expected that so active a hunter would be satisfied with stale food when better is so easily obtained.—WM. WOOD, M. D., *East Windsor Hill, Conn.*

THE DWARF THRUSH.—In the NATURALIST for June there is a notice of a Dwarf Thrush (*Turdus nanus*) killed in Waltham, Mass. On the 1st April, 1866, I had the good fortune to obtain a bird of the same species near Orange, N. J. Like the one mentioned by Mr. Samuels, it was found in a high, dry woodland. I do not, however, consider this fact as of any value in determining its specific difference from *T. Pallasii*, as I have repeatedly found the latter bird in precisely similar localities.*

It may also be interesting to ornithologists to know that a pair of Bohemian Waxwings were observed in this neighborhood on the 28th April, 1867. It is very rarely that this bird ever comes so far south, and then it is usually in the depth of winter.—T. MARTIN TRIPPE, *Orange, N. Y.*

THE HONEY-BEE GLEANING AFTER THE ORIOLE.—Two little girls, the elder scarcely six years of age, were picking the flowers of the Buffalo or Missouri Currant (*Ribes aureum*), "to get the honey." They saw honey-bees around the bushes. They observed that many of the flowers had one or two little holes at the base of the calyx tube, and that such

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*As the following description of the specimen which I shot differs somewhat from that given by Mr. Samuels, I judge it best to insert it here, hoping that it may be of use in settling the still doubtful question as to the specific difference of *T. nanus* and *T. Pallasii*:—Feathers of the crown with their centres much darker than their edges, so as to present a streaked appearance; ear-coverts quite distinctly streaked with white; sides of the body under the wings, and breast with a bluish tinge, the under wing-coverts being of a similar color; throat, belly, and under tail-coverts pure white; tail feathers with a bluish purple tinge, especially on the inner webs. Length, 7 inches; alar extent, 11.10; wing, 3.75; tail, 3. Otherwise as in *T. Pallasii.*

flowers were not as sweet as the others. They said the bees had torn them open with their jaws, and sucked out the honey.

For two seasons I have examined large numbers of these flowers in different parts of the village, and found many of them had been torn open. Several times I have seen the Baltimore Oriole rapidly going over the bushes, giving each fresh flower a prick with the tip of his beak. No other birds have been seen doing this; nor have I ever been able to see a honey-bee attempt to make a hole at the side of a flower. The calyx-tube is too long for the honey-bee, so she contents herself with gleaning after the oriole, selecting the injured flowers, and leaving the fresh ones for birds and humble-bees. — W. J. Beal, *Union Springs, N. Y.*

Remarkable Flight of Crows. — An account of a remarkable flight of crows I once witnessed may, perhaps, be of interest to some of your readers. The organization of which I was a member, was stationed in March and April, 1863, at Poolsville, Md., on the Upper Potomac, midway, or nearly so, between Washington and Harper's Ferry. One afternoon in April I was posted as sentinel "between the guns," with instructions there to walk until six; it was then four.

Soon after being posted, I saw two or three crows fly over, and soon five or six more, followed by nine or ten more; seeing them so increase I thought to count them, and for half an hour or so was able to do so with some degree of certainty; after that they formed one continuous stream, flying east by south in perfect silence. After that I could only estimate their number by calculating how many passed a given point in a minute. There was no apparent diminution in their numbers as the time passed on; but the line shifted towards the north, as though they were advancing "in echelon," and when it finally grew dusky, they still presented the appearance of a low black cloud to the northward, their motion visible only when a break occurred in the line. I estimated that their number was eighty thousand up to the time that darkness prevented farther observation. Some weeks after I spoke with Dr. Thayer, Surgeon of the 14th N. H. Volunteers, on the subject, and found his estimate to be — if I remember rightly — ninety-five thousand. The species was the common *C. Americanus*. — W. E. Endicott.

Singular Deformity in a Silk Moth. — All entomologists, who have much to do with breeding insects, know very well it is not an uncommon occurrence to meet with deformed insects; the deformity is generally in the wings. This deformity is particularly noticeable in that favorite of entomologists, the Lùna moth. Several years ago I gathered quite a number of cocoons of the Cecropia, in order to get some fine specimens among the number. One came out, the wings spread nicely, but the left pair were considerable shorter than the opposite ones. But the most singular deformity occurred this summer. A Cecropia came out without antennæ. I at first thought it had broken them off in escaping from the cocoons, but it was not so; the moth was perfect in other respects. — R. Bunker, *Rochester, N. Y.*

THE HONEY-ANT.—According to Wesmael, a Belgian naturalist, the *worker major* of this singular ant, which lives in Mexico, has the abdomen swollen at times like a balloon, and then perfectly transparent and filled with honey. These individuals are inactive, do not quit the nest, and their sole occupation is to elaborate a kind of honey, which they discharge into receptacles. This is the *Myrmecocystus Mexicanus*, or *hormigas mieleras*, or *mochileras*, i. e. honey-ants, or pouched-ants, of the Mexicans.

The major worker of *Crematogaster inflatus*, according to Mr. F. Smith, has a swollen bladder-like formation on the hinder part of the thorax (metathorax): "This singular apparatus is furnished with a small circular orifice at the posterior lateral angles, from which the saccharine fluid doubtless exudes. We may, therefore, reasonably conclude that this insect elaborates a suitable and necessary aliment for the nourishment of the young brood." A species of "Honey-ant" is also found in Texas.

THE GOLDEN-WINGED WOODPECKER.—A somewhat remarkable case, illustrating well one of the breeding peculiarities of the Golden-winged Woodpecker (*Colaptes auratus*), has just occurred under my notice. A pair of these birds commenced laying about the first week in May, in a nest that had been occupied for several years in succession. I removed the eggs carefully twice a week, leaving two in the nest each time; I have thus obtained thirty-three eggs, thirty-one of which are in my collection, the other two (the last) having been hatched during my absence. Their ordinary number, as every one knows, is only six. This is the most extensive case of the kind I have ever known. Can any of the readers of the NATURALIST surpass it?—W. K. KEDZIE, *Lansing, Mich.*

HABITS OF THE ELEPHANT.—In Ceylon, the Elephant seeks the shade of thick forests at the rising of the sun, in which he rests until about five o'clock, P. M., when he wanders forth upon the plains. In Africa, the country being generally more open, the elephant remains throughout the day either beneath a solitary tree, or exposed to the sun in the vast prairies, where the thick grass attains a height of from nine to twelve feet. The general food of the African elephant consists of the foliage of trees, especially of Mimosas. In Ceylon, although there are many trees that serve as food, the elephant nevertheless is an extensive grass-feeder. The African variety, being almost exclusively a tree-feeder, requires his tusks to assist him in procuring food. Many of the mimosas are flat-headed, about thirty feet high, and the richer portion of the foliage confined to the crown; thus the elephant, not being able to reach to so great a height, must overturn the tree to procure the coveted food. The destruction caused by a herd of African elephants in a mimosa forest is extraordinary; and I have seen trees uprooted of so large a size, that I am convinced no single elephant could have overturned them. I have measured trees four feet six inches in circumference, and about thirty feet high, uprooted by elephants.—BAKER'S *Albert Nyanza.*

MICROSCOPY.

THE WHALE'S FOOD AND THE DISCOLORATION OF THE ARCTIC SEAS.—At the second meeting of the thirty-second session of the Botanical Society of Edinburgh, Mr. Brown read a paper "On the Nature of the Discoloration of the Arctic Seas," the results of researches made on his different scientific voyages to the Spitzbergen and Jan Mayen Sea, and Davis Strait and Baffin's Bay in 1860, and to the coasts of Danish Greenland in 1867, in which he enunciated the following conclusions:

1. That the dark, or deep green portions of the Arctic Sea, described by Scoresby, and before him by Davis and Hudson, are local and permanent, though movable to a certain degree by currents and tides.

2. That this discoloration is not caused by Medusæ, but by immense multitudes of a minute silicious moniliform diatom, found almost solely in these discolored portions. He found that when the immense mass of Beroidæ and other forms of medusoid life, sank (as it will do occasionally beneath the surface), that the sea still retained its peculiar color, but that even the immense mass of diatomaceæ would sink down a few feet, and again, without apparent cause, rise to the surface. At a depth of two hundred fathoms the water was free from diatoms, though at the time the muslin of the towing net was dyed with them as it skimmed along the surface.

3. That these diatoms also accumulate under the floes of ice, as it was found that the brown slimy masses adhering to the under surface of the ice was almost wholly composed of this diatom. It was also found that the heat developed by the masses of diatomaceæ adhering to the under surface had hollowed the ice into honey-combed chambers, giving it the whaler's name of "rotten ice," and so fragile as to be easily thrown aside by the iron-shod prows of the early whaler. "It is not, therefore," remarked Mr. Brown, "carrying the doctrine of final causes too far to aver that this diatom by assisting in the breaking up of the floes, so fearful in their majesty, helps to render the Arctic Ocean navigable to the hardy whalemen, as I will hereafter show it does, by furnishing substance to the noble quarry which leads him hither.

4. The food of the *Balæna mysticetus* Linn. was found to consist wholly of the minute animals swarming in these discolored portions; the other species of *Cetacea* living on fishes and other highly developed tissues. These animals consisted of *Entomostraca*, of which the principal were *Cetochilus arcticus*, and *C. septrionalis*, *Pteropoda*, of which the chief is the well-known *Clio borealis* (which it ought, however, to be remarked, does not form such an item in the food of the whale, as is usually supposed), and stalked-eyed Medusæ, comprising various species of Beroidæ, etc. In the stomachs of all these animals he found this diatom, and from after investigation it was proved that their sole food consisted almost wholly of the species in question, and afterwards the same was remarked of the smaller mollusca.

5. It thus appeared that in the strange cycle of being the whale is dependent on the diatom for its existence. "In conclusion, you will allow me to remark," said Mr. Brown, "that I know nothing stranger in all the annals of biology than the strange tale I have unfolded. Protozoon feeding diatom, diatom feeding entomostracon, and entomostracon the whale; in a word, that the most gigantic of living animals,* whose pursuit affords occupation to thousands of tons of shipping, and thousands of seamen, and whose loss to one little Scottish port was last year estimated at £100,000,† is dependent for its existence on a being so small that it takes hundreds to be massed together before they can be visible to the naked eye, and so insignificant that it is unknown to the men who are most interested in its existence — telling how great are little things. The author gave some of the illustrations of representative species afforded by his discoveries, and we may look for further details on the publication of the paper in a few weeks. — *Land and Water.*

Wanted, a Rotifer. — I have hunted gutters, cisterns, pools, ponds, lakes, ditches, and rivers, and viewed many a "field" alive with wondrous forms of beauty, both animal and vegetable, yet never a Rotifer have I found or seen. I have searched with high powers and low powers, but all in vain. It is true my hunting ground (or water) has been confined to latitude 39°, west longitude 94°-96°, and it may be the object of my search is not an inhabitant of this part of the world. But will some of your correspondents kindly send me a Rotifer if they can find one? I will reciprocate with anything I can find.—W. H. R. L., *Box* 400, *Kansas City, Missouri.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science. — The Seventeenth Annual Meeting of the American Association for the Advancement of Science was held August 5–12, at Chicago, Ill. About two hundred and fifty members were present, and upwards of one hundred and fifty papers were presented. We give below the titles of those read in the Natural History Section. During and after the meeting, free excursion tickets were issued by the railroads centering in Chicago, and many of the members availed themselves of the liberality of the Companies to make excursions to Lake Superior, Omaha, La Salle, Dubuque, Galena, and other places of interest. These, with an excursion for an afternoon on the lake, and the brilliant evening entertainments given by prominent citizens

* Nelson, in his "Skandanavieske Faune," vol. i., gives the weight of the full-grown *Balæna mysticetus* at 100 tons, or 220,000 lbs., equal to 88 elephants, or 442 Polar bears!

† In 1867, the twelve screw steamers of Dundee obtained only two whales amongst them, and it was estimated that the loss to each steamer was £5,000, and the loss to the town was assessed at the figure given.

of Chicago, and the unusual interest and vigor of the meeting, which was largely attended through the entire session, rendered it a brilliant success. The American Association is young and vigorous; it is a practical necessity in this country, and the generous pecuniary support and ready sympathy in its objects given by the communities in which it annually meets, are evidences of the popular interest in the cultivation of the Natural and Physical Sciences.

Officers of the Meeting: Dr. B. A. GOULD, *President*; Col. CHARLES WHITTLESEY, *Vice President*; Prof. JOSEPH LOVERING, *Permanent Secretary*; Prof. A. P. ROCKWELL, *General Secretary*; Dr. A. L. ELWYN, *Treasurer*. Of Section B (Natural History), Prof. J. D. WHITNEY, *Chairman*; Prof. E. D. COPE, *Secretary*; Messrs. WORTHEN, MARSH, and GILL, *Committee*.

PAPERS READ IN THE NATURAL HISTORY SECTION.

Geological Section of Ohio. By *E. B. Andrews*.

On the Plasticity of Rocks, and origin of the Structure of the so-called Grave Stone Slates of California.—On the Gradual Dessication of the Western Portions of North America.—Vestiges of Pre-historic Races in California.—On some of the Causes which affect the Rapidity of Erosion of Rocks and of River Valleys. By *W. P. Blake*.

Effect of Atmospheric Changes on the Eruptions of the great Geyser of Iceland. By *P. A. Chadbourne*.

On a Genus of Extinct Sea-Saurians (*Elasmosaurus*). By *Edward D. Cope*.

On the Formation consisting of Shells and Belemnites, and Phosphates of Iron at Mulica Hill, Gloucester County, N. J. By *A. B. Engstrom*.

On the Boulder Field in Cedar County, Iowa. By *Rush Emery*.

Origin of the Prairies.—Exhibition of the Crania of Boötherium and Castoroides, with Remarks on their Geological Position and their Living Analogues.—The Antiquity of Man in North America.—On the Occurrence of Fluor Spar in Southern Illinois.—On the Refrigeration of Continents.—On the Occurrence of Tin in Missouri. By *J. W. Foster*.

Meteorites from Mexico and Poland. By *Lewis Feuchtwanger*.

On Elasmognathus and its Relations to the Tapiridæ generally.—On the Classification and Relations of Seals. By *Theodore Gill*.

On the Artistic Evidence of the Remote Colonization of the North-western or American Continent by Maritime People of Distinct Nationalities before the Modern Era. By *J. H. Gibbon*.

Report on Archæology and Ethnology.—Archæology and Ethnology of the Mississippi Valley. By *W. De Hass*.

On the Geology of the Mississippi Delta, and the Salt Deposit of Petite Anse. By *Eugene W. Hilgard*.

The Importance of the Submarine Aleutian Chain as a Geostatic and Geographical Feature.—The Hermaphrodism of Fungi ascertained.—The Confervaceæ ascertained to be Thalline; their Phase, Development, Circuit, and Generation.—Spermatic Phenomena.—The Paludal Endogens a Class intermediate between Endogens and Exogens.—The Vertebral Type of the Cranium a Quinary one.—Extremities of the Skeleton typically five.—Anatomical Distinction of Vegetable Structure, etc. By *T. C. Hilgard*.

The Quebec Group in Northern New Hampshire.—The Supposed Triassic Footmarks in Kansas. By *C. H. Hitchcock*.

Farther Notice of Experiments on Snow and Ice at a Temperature below 32° F. By *Edward Hungerford*.

Glaciers as extensive and constant geologic Agencies.—Points in the Geology of Hudson River.—Brief Remarks on the Botany, Meteorology, and Geology of Mount Mansfield, Vermont.—Habits and Peculiarities of Plants in South-eastern New York and Vicinity.—Movements in Stratified Rocks since the Glacial Epoch. By *James Hyatt*.

On Gold in the Laurentian Rocks of Canada.—On the Gold Region of Nova Scotia.—On the Upper Silurian and Devonian Rocks of Ohio.—On Some Points in the Geology of Vermont. By *T. S. Hunt*.

Source of Muscular Power.—Relations of the Metamorphoses of the Phosphates to Waste and Repair.—Fluorine a Constituent of the Brain. By *E. N. Horsford*.

Superficial Geology of the Lake Shore near Chicago. By *J. S. Jewell*.

Sketch of the Topography, Geology, and Antiquities of the Caucasus. By *F. Von Koschkull*.

The Periodic Law in the Failure of Harvests and Inundations, with Suggestions as to their Insurance. By *George A. Leakin*.

On the Leaves of Coniferous Plants. By *Thomas Meehan*.

Bibliography of Entomology in the United States and Canada, since 1862. By *John G. Morris.*

The Darwinian Theory of Development. By *Charles Moran.*

Description of a New Species of *Protichnites* from the Potsdam Sandstone of New York. — Notice of Some New Vertebrate Remains from the Tertiary of New Jersey. — On the Preservation of Color in Fossils from Palæozoic Formations. By *O. C. Marsh.*

Migrations of the Indian Family. By *L. H. Morgan.*

On Two New Fossil Trees, the oldest known, found by Rev. H. Herzer, in the Devonian Rocks of Ohio. — On the Physical Geography of the Continent of North America during the different Geological Periods. — On the Transportation of the Materials forming the Carboniferous Conglomerates. — On the Surface Geology of the Basin of the Great Lakes and the Upper Mississippi Valley. By *J. S. Newberry.*

On the Archæological Value of Certain Ancient Beads. By *L. G. Olmstead.*

The Habitable Features of the North American Continental Plateau near the Line of 35° Parallel North Latitude; containing a General Summary of Conclusions derived from a Review of its Aboriginal Population and Natural Features. By *C. C. Parry.*

On the Structure and Aqueous Origin of Gold-bearing Mineral Veins. — On the Occurrence of the Mastodon in the Deep-lying Gold Placers of California. By *Benjamin Silliman.*

Law of the Earth. — New Geological Study. By *P. E. Trastour.*

Phases of Glacial Action in Maine at the Close of the Drift Period. By *N. T. True.*

The Distortions of Pebbles in Conglomerate at Rangley, Maine. By *G. L. Vose.*

On the Old Lake Beds of the Prairie Region. By *S. J. Wallace.*

On the Stratigraphical Relations of the Fossil Horse in the United States. — Abstract of the Geological Evidences of Man's Antiquity in the United States. By *Charles Whittlesey.*

On the Progress and Present Condition of the Geological Survey of California. — The Fossil Human Skull of Calaveras County, California. Some Points in the Surface Geology of the Western Side of the American Continent. — The Yosemite Valley. By *J. D. Whitney.*

Geological Age and Equivalents of the Marshall Group. Part I. Stratigraphical Considerations; Part II. Palæontological Considerations. — On the Secular Recurrence of Identical Petrogenetic Conditions. — Exhibition of a New Geological Chart. — Exhibition of a New Label Holder for Zoölogical Specimens. — On some Points in Geological Nomenclature. By *A. Winchell.*

Geodes. — Modern Discoveries in Palestine. By *W. W. Williams.*

Announcement of the Discovery of Cretaceous Rocks in Guthrie County, Iowa. — Remarks upon the Red-quartzite Boulders and their Original Ledges *in situ* in Northwestern Iowa, Eastern Dakota, and South-western Minnesota. By *C. A. White.*

Fuel Resources of Illinois. — Fossil Fishes, Insects, Crustacea, etc., of the Coal Measures of Grundy County, Illinois. By *A. H. Worthen.*

On Certain Physical Features of the Mississippi River. By *G. K. Warren.*

Supplementary Notes on Gold-Genesis. — Some New Facts and Views concerning Aluminum. — Upon the Ammonoosac Gold Field in New Hampshire. — Studies of the Red Sand Stones of the Atlantic Slopes, and their enclosed Igneous Masses. — Notes upon the *Palæotrochis.* By *Henry Wurtz.*

Col. WHITTLESEY gave the following data regarding the Antiquity of Man in the United States. 1. Refuse shell-heaps of the Atlantic Coast, from Nova Scotia to Florida. Age not determined, but not very great. 2. Flint arrow-heads beneath Mr. Koch's skeleton of the mastodon in a peat layer, covered by alluvium fifteen feet deep, at Pomme de Terre River, Missouri. 3. A flint knife at Grinnel Leads, Kansas, found by P. A. Scott, at a depth of fourteen feet, in gravel and clay. 4. Three human skeletons of Indians, in a shelter cave at Elgin, Ohio; estimated age two thousand years. 5. A log worn by the feet of man, probably Indians, in the muck bed at High Rock Spring, Saratoga Springs, N. Y., at a depth of nine feet beneath the cone, estimated by Dr. Grier to be 4,840 years old. 6. Copper spear-heads and other implements with human skeletons, apparently of the mound builders, at a depth of fourteen feet, at Brockville, Canada; found by Dr. J. Reynolds. 7. Several human skeletons in a cave near Louisville, Ky., with stone and flint implements; by J. N. Scowden. 8. Pottery found by Dr. Holmes, associated with remains of the mastodon and megatherium, at Charleston, S. C. 9. A human jaw, teeth, and other bones, in quarternary conglomerate at Florida, estimated

by Agassiz at 10,000 years. 10. Fire-hearths, found by C. Whittlesey, in the ancient alluvium of the Ohio, at Portsmouth, Ohio, at a depth of twenty feet, and beneath the works of the mound builders. 11. Skeletons of Indians, reported by Dr. Dowler, of New Orleans, at a depth of sixteen feet in the alluvium, estimated by him at 50,000 years; by others as low as 15,000. 12. Portion of a pelvic bone of man, at Natchez, Miss., associated with the mastodon, megalonynx, and horse, supposed to be in the loess, but of doubtful authority. 13. Human skull and other relics, Calaveras county, California, at a depth of 150 feet in superficial materials, containing gold; reported by Professor J. D. Whitney.

In the discussion on the Antiquity of Man, Mr. J. W. FOSTER assigned the ancient Peruvians to the Bronze age, attributing to them a commercial intercourse with foreign lands; copper instruments having been discovered which may have come from the Copper Mines of Lake Superior, and of mica, which may have been brought from New England. He also mentioned that the mound builders wove cloth spun with an uniform thread, and woven with a warp and woof.

Professor W. P. BLAKE stated that the evidences of an ancient race were frequent in California. The miners in sluicing the beds of the ancient streams find frequently spear and arrow-heads of stone, which testify to the skill of humanity, as well as that they are not the work of a race now known. Among the first of these evidences discovered, were some human molar teeth associated with gold in the stratum of auriferous drift, at a depth of fifteen or twenty feet. He did not see these in their place, but he did not doubt the truth of their being so found. Implements of stone, too, are found from time to time in the gold drift, and within two or three years bones of a skull itself had been so found. Two years since one side bone of a skull was found. It was taken from the end of a tunnel running two hundred feet into the side of a mountain. The fragment was fresh in appearance and unchanged by any solution; the surface was bright, the sutures worn round and closely filled with gravel and fragments of minerals, such as were to be found in the gold drift. The conviction was forced upon him, by an examination, that it was really a portion of a skull, as it was said, and that it had for ages, perhaps, rolled in the drift. Stone implements are found in various parts of the State, but more frequently in the central portions, and more especially in the region of Colombia, Sonora, and along the Table Mountain, the two latter furnishing the finer specimens. In close associati n with these remains are found relics of the mastodon and the tapir. The Table Mountain he described by diagram. Whereon the mountain now stands was a valley, traversed by a river. Here ages since there commenced a deposit of stone, with gold, pebbles, mud, and sand. Volcanic action had encrusted these with ashes, and at last all had been covered with the lava. As the valley filled up, the water of the river cut on each side of the accumulating mass a channel, commencing at the base of the deposit of lava. In time it washed its way until now the Table Mountain stands erect, and

two valleys are formed, one on either side. This mountain extends with its flat summit for miles, its surface edge being a bold bluff of black appearing rock, with little or no vegetation upon its plane. The thickness of the entire deposit averaged from one to two hundred feet, the height of the lava above the bed of the newly-formed valleys being from one thousand to fifteen hundred feet. The miner, seeking the auriferous deposit, having, by sinking shafts, ascertained the greatest depth of the whole deposit, tunnels from the side of the valley, and this process had brought to light teeth of extinct mammalia as well as relics of human art. He exhibited lithographs to show the nature of some of these last spoken of relics. Among them were two stone objects which he supposed to be shovels used in cooking, by placing them upon or into the burning fuel; a mortar or dish, some instruments resembling plummets, and several spear-heads.

Professor E. D. Cope read a paper on a new and gigantic Sea-Saurian (*Elasmosaurus platyurus*) from the Cretaceous formation of Central Kansas. Preliminary to it he stated that one hundred species of North American extinct reptiles and batrachians were known to him, of which some twenty were yet unpublished. He gave a synopsis of the characters of the *Dinosauria*, showing their nearer affinity to the birds than that presented by the Pterodactyles, in the structure of the pelvis, the tibia, fibula, tarsus, etc. He alluded to the great number of extinct tortoises of the New Jersey Green Sand, and to the first fossil serpent from this country, the *Palæophis littoralis* of the Eocene Tertiary formation of New Jersey.

Professor T. S. Hunt remarked that the borings for oil in the south-western Ontario region, had enabled the Canadian Geological Survey to measure the thickness of these formations. A layer of rock-salt, forty feet thick, had been discovered in the Lower Devonian rocks, and also a deposit of gypsum. This shows a condition of very slight precipitation of moisture, and of very great evaporation at that time. The petroleum was thought to originate in the Lower Devonian limestones. The borings show that the south-west portions of Lakes Erie and St. Clair have been excavated from the Quaternary formation.

Dr. C. A. White announced the discovery of sandstones and conglomerates of the Dakota group of Cretaceous rocks in Guthrie county, Iowa, one locality being forty miles west of the city of DesMoines. Also, that he had traced, step by step, the red quartzite boulders profusely scattered in the drift of Western Iowa, to their original ledges of red quartzite in North-western Iowa, Eastern Dakota, and South-western Minnesota. This quartzite is the same rock which causes the Sioux Falls of the Big Sioux River, and the same which encloses the layer of red pipestone in South-western Minnesota.

Prof. P. A. Chadbourne stated in regard to the Effect of Atmospheric Changes on the Eruptions of the Great Geyser of Iceland, that Sir W. Hooker, who visited Iceland in 1809, mentions that eruptions of the Great Geyser most frequently occurred in fair weather, and this is the account

now given by those who live near the geyser. Eruptions do not occur until the water in the bottom of the geyser-pipe is 266° F., as shown by Bunsen's observations. The time taken to raise the water in the pipe to 266° F. will evidently depend upon the quantity of water poured in a given time through the fissures that feed the pipe. As the water is supplied by the hills near the geysers, a fall of rain readily affects the quantity of water flowing through the pipe. The greater the quantity, the greater will be the time between the eruptions. If the quantity of cold water poured into the pipe were so great that the bottom of the pipe could never rise to a temperature of 266° F., there could be no eruptions. It is from the enlarging of the water channels by earthquakes, so as to pour in more water, that some geysers that were formerly active have now become quiet.

In discussing the remarks of Mr. Rush Emery "On the Boulder-field in Cedar County, Iowa," Dr. C. A. White and Professor Winchell stated that there were some evidences of a northward distribution of boulders in Iowa and Michigan.

Col. J. W. Foster alluded to the large size of the *Castoroides*, or fossil beaver, adopting the view of Professor E. D. Cope, that it must have been nearly as large as the grizzly bear.

Col. C. Whittlesey enumerated the localities and geological age of the deposits in which remains of the horse had been found. Professor E. D Cope insisted that though no difference had been discovered between the teeth of the living and fossil species of horse, yet they may be, and probably were, of entirely different species; the living species having been introduced by Europeans.

Mr. T. Meehan thus summed up the results of his studies on the Leaves of Conifers. The true leaves of Coniferæ are usually adnate with the branches. Adnation is in proportion to vigor in the genus, species, or in the individuals of the same species, or branches of the same individuals. Many so called distinct species of Coniferæ are the same; but in various states of adnation.

We shall conclude our notices of the papers read in the next number.

The next meeting of the Association will be held in Salem, Mass., commencing on Wednesday, August 18, 1869. The following are the Officers for next year: Col. J. W. Foster, Chicago, *President;* Prof. Ogden N. Rood, New York, *Vice President;* Prof. Joseph Lovering, *Permanent Secretary;* Prof. O. C. Marsh, New Haven, *General Secretary;* Prof. A. L. Elwyn, Philadelphia, *Treasurer.*

Academy of Natural Sciences, *Conchological Section.—Philadelphia, July* 3, 1868.—Mr. Wm. M. Gabb called attention to the variation in type that takes place in genera during successive geological periods. He remarked that when a genus attains a strong numerical development in species in any one age, those species belonging to other periods, especially those most removed from the chronological centre of development, so to speak, are usually more or less aberrant from the average

typical form of the genus. This is so marked, that the experienced palæontologist can often recognize the geological age of a group of fossils by their *facies*, as it is termed, *i. e.* their general appearance. Nor is this peculiarity confined to the stratigraphical range of genera; it applies also to their geographical distribution, as every working naturalist knows and practically admits constantly in his studies.

Mr. Roberts exhibited fine specimens of *Anodonta fluviatilis* Dilw., and *A. implicata* Say, collected in the vicinity of Philadelphia, noted for their enormous size as well as for their numerous deformities, caused undoubtedly by some peculiarity of their locality. Out of a large number of specimens of the genus obtained, but one specimen of *Anodonta Tryonii* Lea was found, showing its great rarity in the vicinity of the original locality.

Boston Society of Natural History. *Feb.* 26, 1868.—The Secretary read a letter from Dr. Lincecum, of Texas, describing the ravages of the grasshoppers in that State. Last spring the young hatched from the egg in the early days of March; by the middle of the month they had destroyed half the vegetation, although the insects were wingless and not larger than house-flies. The first winged specimens were seen high in the air at about three o'clock in the afternoon; as a light northerly breeze sprang up, millions came whirling down to the earth, covering the ground in an hour, and destroying every green thing with avidity. During the night they were quiet, but at daybreak commenced to eat, and continued until ten in the morning, when they all flew southward. At about three o'clock in the afternoon of the same day another swarm arrived, ten times as numerous as the first; these again took flight the following day; and thus they continued, coming and going, day after day, devouring the foliage and depositing their eggs. At first they selected bare spots for this purpose, but finally the whole surface of the earth was so broken up by their borings, that every inch of ground contained several patches of eggs. This visitation was spread over many hundreds of miles.

Mr. S. H. Scudder exhibited two fossil insects from the coal-measures. One was the broken wing of a gigantic lace-winged fly, obtained at Morris, Illinois; the other an imperfect leg of a cricket, and a very small fragment of its wing from Northern Ohio. The peculiarity of the leg consisted in its having several prominences on the tibia, while the femur was smooth; the reverse is invariably the case among the living types.

April 15.—The President gave some results which he had reached in comparing a series of crania of wandering Tsuktshi from the Asiatic side of Behring's straits with those of Esquimaux and of Indians from Alaska, Puget's Sound, and California. The crania of the Tsuktshi were collected for the Smithsonian Institution by Mr. William H. Dall, a zealous naturalist attached to the exploring expedition under the direction of the Western Union Telegraph Company. It appears that the crania of the Tsuktshi and Esquimaux, which closely resemble each other in their strongly marked Mongolian features, differ materially both from the crania of the other races and from those of the Indians of Alaska, who

live in such close proximity to them. These comparisons sustain the view that the Esquimaux and Tsuktshi had a common origin, and the easy communication between the Asiatic and American Continents renders it all the more probable; a recent map, published by the Coast Survey, shows that the breadth of the straits at one point is less than fifty miles, while the Diomede islands furnish a convenient resting-place midway between them.

Dr. C. T. Jackson called the attention of the Society to some of the modern methods for the preservation of wood. Mr. W. T. Brigham stated that foreign vessels entering the ports of China were attacked to a frightful degree by the teredo, while Chinese boats, although often made of the same wood, escaped. After vainly endeavoring to ascertain what preventive was used by the Chinese, he discovered the natives sprinkling tar on a fire beneath a vessel, and perceived a strong smell of creosote.

The Dana Natural History Societies. — Seeing a small notice of some of the Dana Natural History Societies in your June number, I send you a brief account of the history of this organization. The chief object of this Society is to awaken and extend among the people generally, and especially among the women of our country, a greater love for the study of nature. The first Chapter with the name of the Dana Natural History Society was organized about a year ago, in Ripley Female College, Poultney, Vt., and since that time *eighteen* additional Chapters have been organized in different parts of the country. The following is a list of the various Chapters of the Dana Natural History Society, and their Corresponding Secretaries:

1. Ripley Chapter. Miss L. A. Plympton, Corresponding Secretary, Poultney, Vt.
2. Evanston Chapter. Miss Fannie Stout, Corresponding Secretary, Evanston, Illinois.
3. Rockford Chapter. Miss Ellen R. Shepherd, Corresponding Secretary, Rockford Seminary, Rockford, Ill.
4. Troy Chapter. Miss Myra Griswold, Corresponding Secretary, Willard Seminary, Troy, N. Y.
5. Greenwood Chapter. Miss Mary E. Cobb, Corresponding Secretary, Greenwood Seminary, West Brattleboro, Vt.
6. Tilden Chapter. Miss Augusta Robinson, Corresponding Secretary, Tilden Seminary, West Lebanon, N. H.
7. Maplewood Chapter. Miss Annie M. Bottom, Corresponding Secretary, Maplewood Institute, Pittsfield, Mass.
8. Raritan Chapter. Miss L. B. White, Corresponding Secretary, Matawan, Monmouth County, N. J.
9. Tappan Zee Chapter. Miss Louisa B. Hendrikse, Corresponding Secretary, Rockland Female Institute, Nyack, N. Y.
10. Chicago Chapter. Miss Alice Walbridge, Corresponding Secretary, Dearborn Seminary, Chicago, Ill.
11. Hyde Park Chapter. Miss H. L. Daniels, Corresponding Secretary, Hyde Park, Cook County, Ill.
12. Rockford Chapter. Miss Hattie Telfon, Corresponding Secretary, Miss Eastman's Seminary, Media, Penn.
13. Abbottsford Place Chapter. Miss Emma Judson, Corresponding Secretary, 1350 Pine street, Philadelphia.
14. Ionic Chapter. Miss J. C. Thompson, Corresponding Secretary, 608 Marshall street, Philadelphia.
15. Cuviere Chapter. Miss J. Pindell, Corresponding Secretary, Pittsburgh Female College Pittsburgh, Pa.

16. Iron City Chapter. Miss Helen M. Wellman, Corresponding Secretary, Pittsburgh, Pa.

17. Wheeling Chapter. Miss Lizzie Harbour, Corresponding Secretary, Wheeling, West Va.

18. Mount Holyoke Chapter. *——— ———, Corresponding Secretary, Mount Holyoke Seminary, South Hadley, Mass.

19. Fort Edwards Chapter. *——— ———, Corresponding Secretary, Fort Edwards Institute, Fort Edwards, N. Y.

The Raritan Chapter gave an evening entertainment that was highly appreciated by the audience, and realized them quite a handsome amount for their cabinet and library. We hope, and doubt not, that their efforts will result in a permanent benefit to the county and the cause of science. —ADRIAN J. EBELL.

ANSWERS TO CORRESPONDENTS.

A. T., Brookfield, Mo.—We will send you a collection of Eastern minerals and rock specimens in return for Western insects, and wasps' and bees' nests, etc.

J. L. B., West Nottingham, Md.—The plant is the *Chrysogonum Virginianum.*

A. S. N., Cleveland, O.—The insect you send is the larva of a bug, one of the *Pentatoma* group of the Hemiptera.

H. J. R., Cazenovia, N. Y.—The insects were *Membracis binotata* Say, a species of treehopper. Eastward it is found on *Celastrus scandens.*

"A Subscriber," and several other anonymous friends, as "S. H.," "X. Y. Z.," "N." etc.—We cannot answer anonymous letters.

G. W. R., Hartford, Conn.—The Caterpillars you sent are the larvæ of a species of saw-fly, which also attacks the pear trees in this vicinity. As the mature insect has not appeared, we cannot yet give you its name, but will do so if successful in rearing the caterpillar. It is not the common Pear-slug.

C. A. S., Grand Rapids, Mich.—The beetles (*Clytus*) which you found May 19th in the locust had evidently just changed from the pupa, and the white bands would have turned yellow on being exposed to the sunlight. They fly about in July, when they lay their eggs.

F. L., New York.—You can procure the publications of the Smithsonian Institution of B. Westermann & Co., 440 Broadway.

Mrs. K. N. D., Chicago.—Many thanks for your kindness.

R. C., St. Louis.—Mr. James Ridings, 518 South 13th street, Philadelphia, has Insect Pins for sale.

A. W. H., Ft. Madison.—The large spotted egg in the finch's nest was undoubtedly that of the Cowbird, or Cow Blackbird (*Molothrus pecoris*), which never builds a nest, but deposits its eggs in the nests of a good many species of small birds. It belongs to the family of Blackbirds (*Icteridæ*).

D. P. W., Grantsville.—For notices of works on Taxidermy, see Vol. I of NATURALIST, p. 160 and p. 221. There is also *Directions for Collecting and Preserving Birds*, by Mr. Holder, with several plates, in the fourth volume of the Illinois State Agricultural Transactions, p. [illegible]. This last is the best article for a beginner we have seen published in this country.

J. L. S., [illegible].—For measuring eggs, you can get of any instrument maker a scale divided into inches and hundredths of an inch, to which two upright pieces are fixed, the one at the end being soldered to the scale, and the other movable, very similar to the measure used by a shoemaker in taking the size of a foot. By placing the egg against the upright piece at the end, and moving the other up to it, you will get the exact size of the egg measured on your scale. Or, you can take a common rule and two pieces of wood or card for the uprights; or you can get the size of the egg by calipers, and then measure the distance on a rule.

H. J. McL., Centralia, Kansas.—The bird you call a "Snipe" is the Long-billed Curlew, *Numenius longirostris* Wilson. Found in "the entire temperate regions of North America" *Baird*. It is one of the Snipe family. Your "Orange-head" is the Yellow-headed Blackbird, *Xanthocephalus icterocephalus* Baird, a true Blackbird. We shall print what you write about it.

Mrs. J. C., Meredith.—Money received and "Naturalist" forwarded as requested. Many thanks.

* Not having elected Corresponding Secretaries when I left them, I am unable to give their names at present.

Fig. 3.

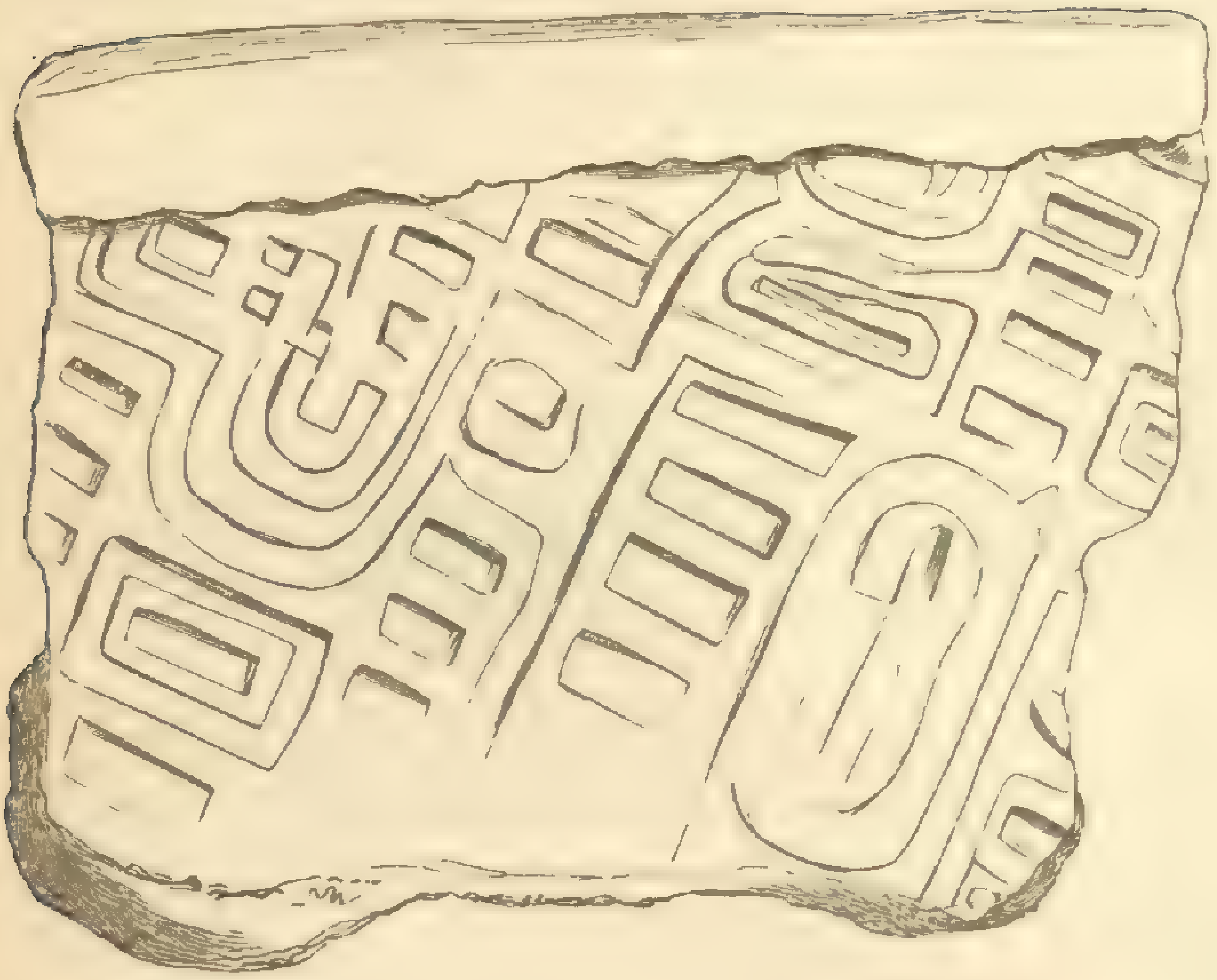


Fig. 1.

Fig. 2.

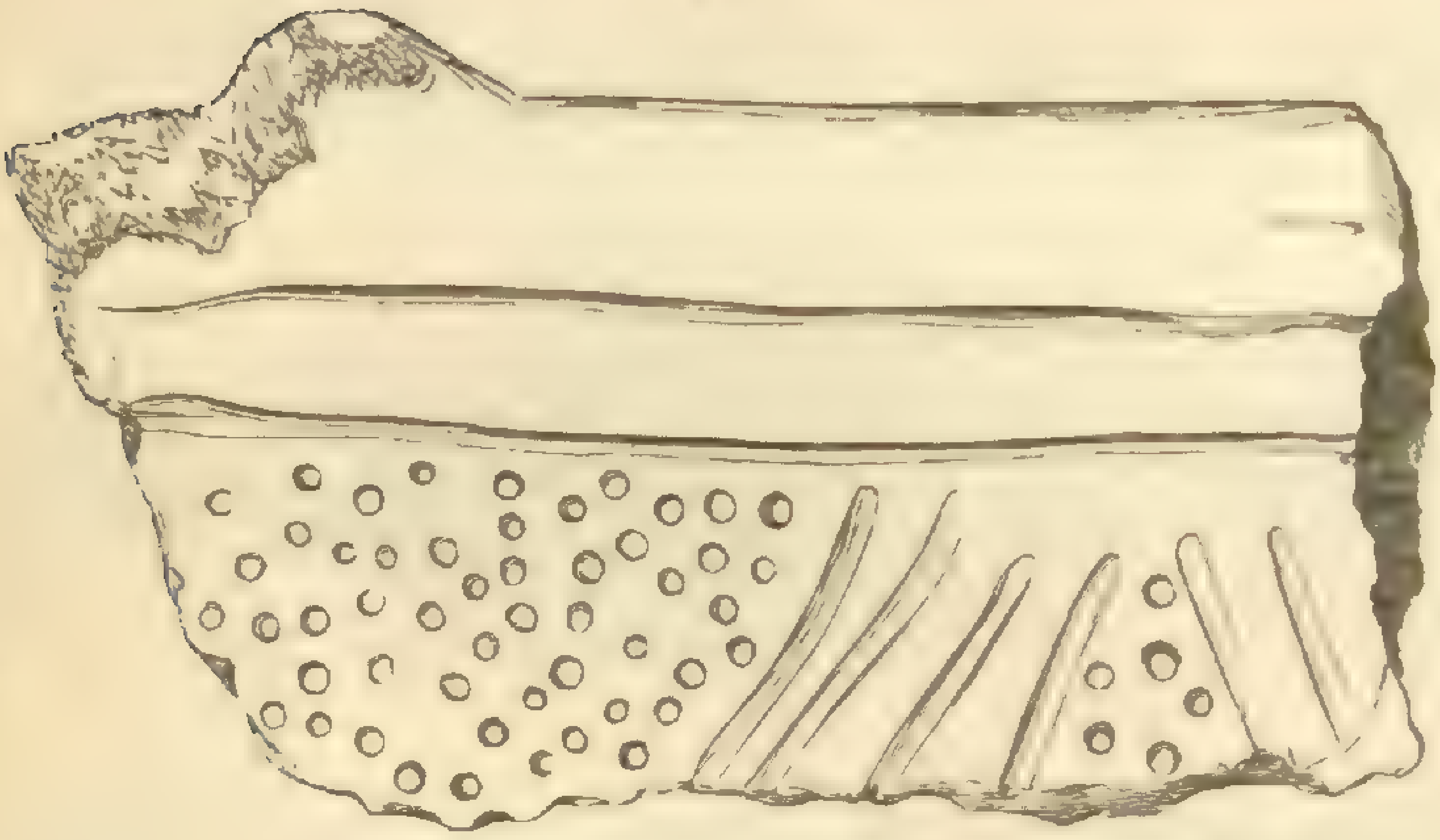


Fig. 5.

Fig. 12.

Fig. 6.

Fig. 11.

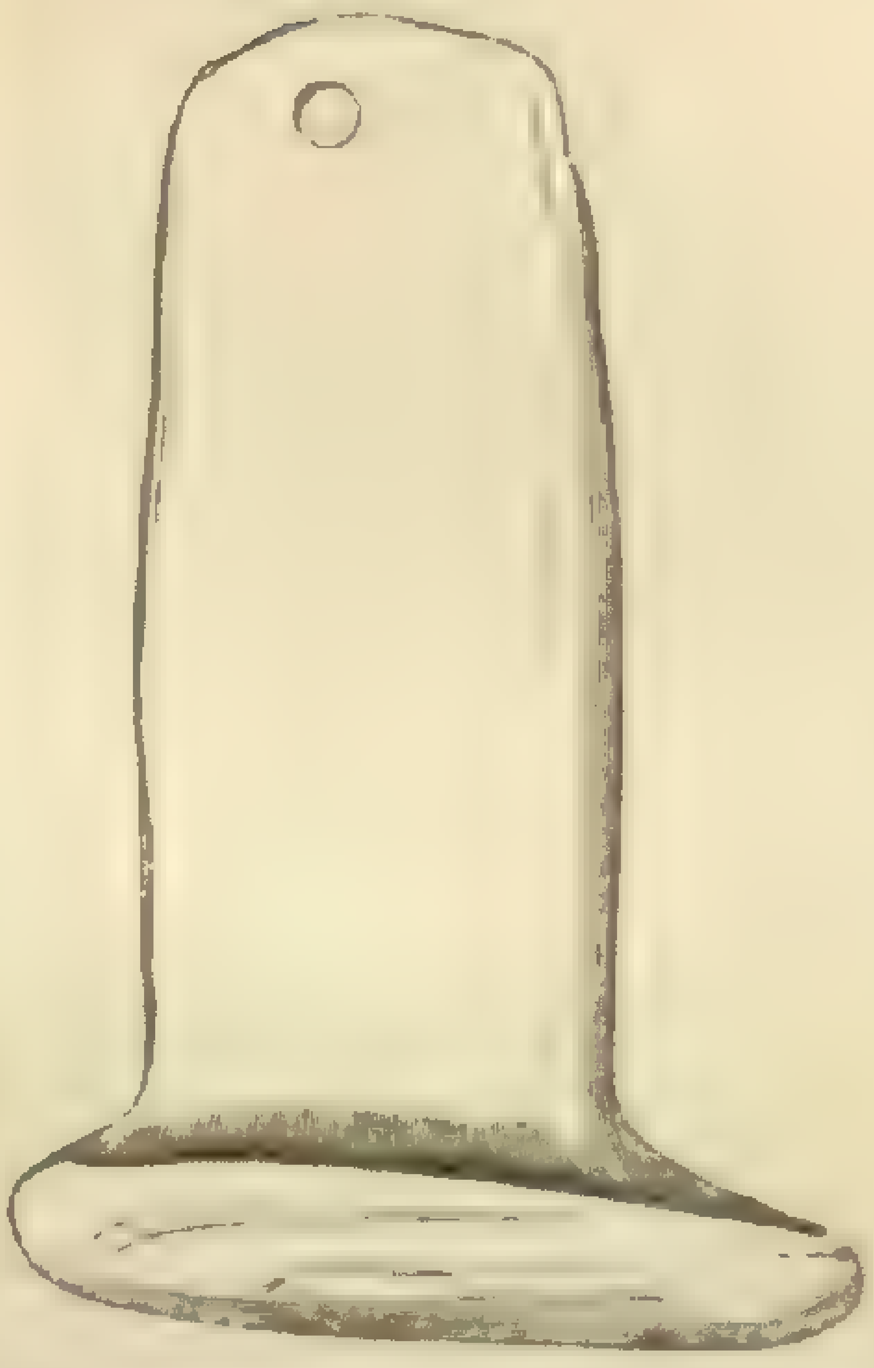
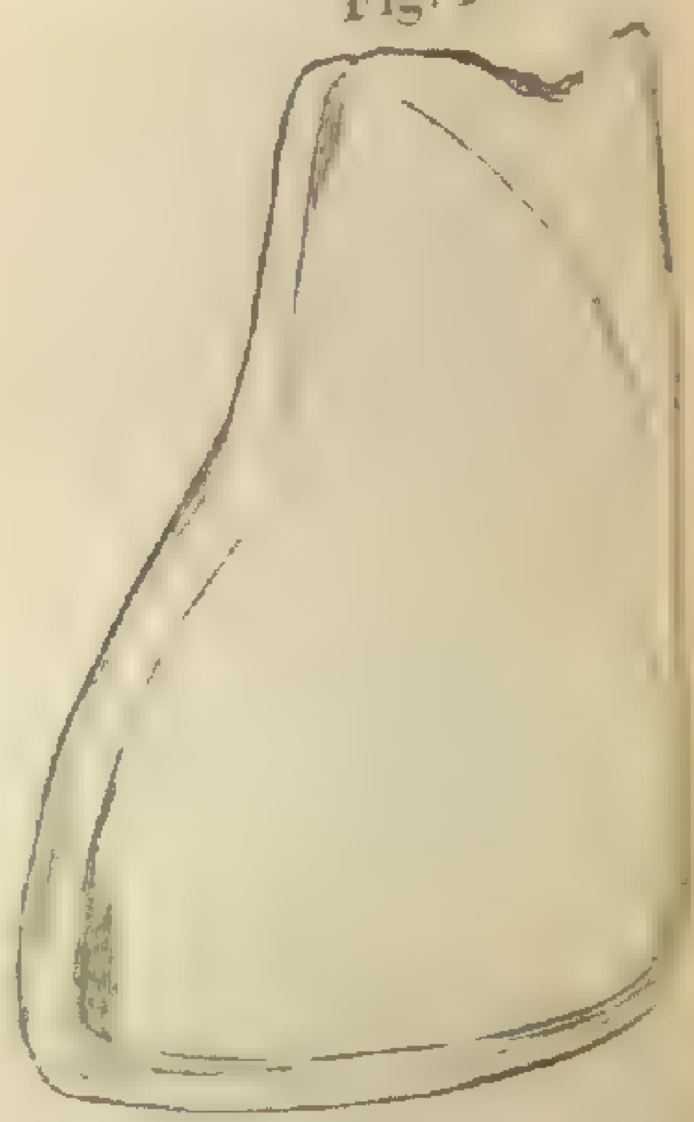


Fig. 10.

Fig. 4.



WYMAN ON THE SHELL-HEAPS OF FLORIDA.

THE

AMERICAN NATURALIST.

Vol. II.—OCTOBER, 1868.—No. 8.

ON THE FRESH-WATER SHELL-HEAPS OF THE ST. JOHNS RIVER, EAST FLORIDA.

BY JEFFRIES WYMAN, M. D.

THE St. Johns River, on the banks of which are to be seen the mounds described in the following pages, has, in several respects, a peculiar interest. It rises near the middle of the eastern half of the peninsula of Florida, in two series of lakes and swamps of great extent, one of which finds its outlet through the upper portion of the main stream, and the other through the Oklawaha, the largest of its tributaries. These waters are separated by land scarcely rising above their level, from another chain of lakes and swamps which have an outlet southwards through the Kissimmee, and thence into the great lake of Okee-Chobee, which has an area of about eight hundred square miles. Other waters, starting from the same region as the preceding, but separated from them by a low range of sand-hills, are discharged westwards into the Gulf of Mexico, chiefly through the Withlokootchee. Though extremely crooked, the general course of the St. Johns is somewhat to the west of north, and in its various windings is supposed to traverse a distance of three hundred miles. Its frequent enlargements, as at Lake Harney, Lake Monroe, Lake George, and its great breadth

Entered according to Act of Congress, in the year 1868, by the PEABODY ACADEMY OF SCIENCE, in the Clerk's Office of the District Court of the District of Massachusetts.

from Palatka to its mouth, almost justify the designation of it as a chain of lakes rather than a river. Flowing through a region which is nearly of a dead level, its stream is necessarily sluggish.

There is much dry and arable land, but so little is this raised above the level of the river, that, were it depressed five or six feet, the ocean would reassert its sway over a large part of the eastern portion of the peninsula, leaving only narrow ridges along the sea-coast, and inland, here and there low islands. As it is, immense tracts are under water throughout the year, and the whole area drained by the St. Johns is a combination of dry land, swamps, lagoons, and creeks. Open prairies, pine barrens, palmetto hammocks, mixed forest growths, chaparals of saw-palmetto, thick jungles, and large tracts overgrown with tall reeds or rank grass vary the surface. From the absence of a change of level in the land, the distant views on the river are extremely monotonous, while the near ones are often of great beauty, because of the windings of the river, and the subtropical vegetation. The creeks and lagoons, with their rank vegetation, and also the wilder shores of the river, shelter vast numbers of water and shore birds, and also countless alligators, water moccasins, frogs, and other reptiles.

Of animals suitable for the food of man there is an abundance, as will be seen farther on, so that along the banks of the river and its tributaries, hunter-life could be easily sustained. The aborigines were, however, planters as well as hunters, for the first explorers found the land largely tilled, and the "Indian-old-fields" which can still be traced bear witness of the fact. Of all the American races none appear to have occupied a region more nearly equally divided between land and water, or one which had been more newly lifted above the level of the ocean, than natives of the shores of the St. Johns.*

*For a description of the physical features of the St. Johns River, the reader is referred to an article entitled *Cursory Remarks on East Florida*. By Major Henry

The shell-heaps we are now to describe were visited during the months of February and March, 1867, in company with Mr. G. A. Peabody, of Salem, Mass., and Mr. George H. Dunscombe, of Canada West, to both of whom the writer is largely indebted for aid in making explorations and for valuable contributions to his collections. The heaps are distributed over a distance of more than one hundred and fifty miles, between Palatka and Salt Lake, and are nearly all situated on knolls, seen here and there on the borders of the river, though a few are built in swamps or on dry land, at some distance from it. They are composed almost exclusively of one or more of the following species of shells, namely, *Ampullaria depressa* of Say, *Paludina multilineata* Say, and *Unio Buckleyi* Lea. Besides these, a species of Melania and a few Helices are found, but they, as well as a few marine shells, must be considered as accidentally present. The mounds vary much in size, from circular heaps fifteen to twenty feet in diameter, and a few inches high, to long ridges several hundred feet in length, and having a height from a few inches to four or five, and in some cases to fifteen feet. They are generally overgrown with oaks, maples, palmettos, bays, magnolias occasionally, and other forest trees, and not unfrequently with groves of the wild orange. The last, bearing a fruit both bitter and sour, has been supposed to be indigenous; but it would appear from the researches of Mr. G. R. Fairbanks, a gentleman thoroughly versed in the history of the peninsula, that they were introduced by the Spaniards.* We personally visited more than twenty-five of these heaps, but only a few of them

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Whiting, U. S. A. American Journal of Science, Vol. XXXV, p. 47. To those who wish an introduction to, and a digest of, the literature pertaining to the whole State, the excellent work, *Notes on the Floridian Peninsula*, by Daniel G. Brinton, A. B., Philadelphia, 1859, is invaluable. This work also contains an account of the author's own investigations of the shell-heaps of the sea-coast.

* Mr. Fairbanks has observed that they are confined to the best camping-places on the river, and it does not appear that they are described or referred to in any of the Spanish records, which it is presumed they would have been, had the Spaniards found them there, since they so particularly mention other fruits. They are probably the Seville Orange run wild.

will be described, as they are nearly all essentially alike; an enumeration of the whole series will, however, be given at the end of the article.

The mounds of oyster-shells on the sea-coast of Florida have long since attracted attention; some of them have been described by Dr. Brinton, who has clearly set forth the grounds for the conclusion that they are of human origin.* The fresh-water shell-heaps have received but comparatively little notice, and have generally been supposed to be either fluviatile or lacustrine deposits, for which any one might certainly be excused for mistaking them at first glance. That they are the works of man the following observations are intended to show. Count Pourtales, however, visited the shell-heaps at Old Enterprise, Lake Monroe, in 1858, when he obtained from among the shells fragments of pottery, and of the bones of animals. He has not published an account of his observations, but informs me that he came to the conclusion that this mound was artificial.

The existence of shell-heaps in other regions consisting of the remains of fresh-water species, though from time to time noticed, have not been generally recognized. The first observation that we have seen with regard to them is by Atwater, who described mounds of mussel-shells on the banks of the Muskingum River, containing various articles of human workmanship.† Dr. Brinton, while connected with the Army of the Cumberland in the war of the rebellion, observed mounds of mussel-shells which had served to supply food to the Indians;‡ and during the last year the writer, in company with Mr. Ralph Waldo Emerson, Mr. Elliot Cabot, and others, examined a similar deposit on the banks of the Concord River, in Massachusetts, consisting of *Unio complanatus*, and containing charcoal, pieces of worked bone and flint.§ I am also informed by Professor J. D. Whitney, the

* Notes on the Floridian Peninsula, p. 166.

† Archæologia Americana, Vol. I, p. 226.

‡ Smithsonian Reports, 1866, p. 356.

§ Proceedings of the Boston Society of Natural History, Vol. XI, p. 243.

chief of the Geological Survey of California, and Dr. William H. Brewer, botanist to the same survey, that vast numbers of fresh-water shell-heaps exist there. Indeed there is an abundance of evidence for the belief that they are widely scattered throughout the United States.

I. SHELL-HEAPS.

King Philip's Town. This place was in a wild state until quite recently, and derives its name from a Seminole chief, who, it is said, once occupied it. The shell-heap, now converted into an orange grove, is on the left bank of the river, about a mile below the outlet of Lake Harney. Its situation is favorable both for hunting and fishing; the river is here sixty or seventy yards wide; opposite is the mouth of Deep Creek,* rising far to the eastward, and pouring into the St. Johns an excellent quality of water; to the rear and westward are open prairies and pine lands, and in the distance, to the north, is a large lake. The river contains an abundance of fish, but generally of a poor quality, except in the month of February, when vast numbers of shad pass on their way to Lake Harney, two hundred miles from the mouth, to spawn. While we were encamped here, the splashing of the water by shoals of these fish could be heard at all hours, from evening twilight to early dawn.

The shell-mound is about four hundred and fifty feet in length, and from a hundred to a hundred and twenty in breadth. It stretches at right angles to the river, borders a lagoon on the south, and on the north merges into cultivated fields, over which its materials have become somewhat scattered. Its greatest height is about eight feet. Fragments of pots may be picked up anywhere on the surface, and, with these, bones of various edible animals. As all such remains may have been deposited on the mound after its completion, excavations were made at many points from a few inches to

*There is another creek of the same name which enters the St. Johns on the right bank, between Pilatka and Picolata.

several feet in depth, to ascertain if similar objects were buried in its interior. The most unequivocal evidence that this mound, while in the process of formation, was occupied by the aborigines, was obtained from a pit between four and five feet in diameter, and from five to six feet deep, which was dug near the centre. Not only were fragments of pots and bones found at all depths, but at a depth of three feet the remains of an old fireplace were uncovered, consisting of a horizontal layer of charcoal, beneath which were perfectly calcined shells, and near these others more or less blackened with heat. Still farther off were fragments of the bones of deer, of birds, turtle and fish, all just as they would naturally have been left around a fire, where cooking had been for some time carried on. In addition to the above statement it may be mentioned as a matter of negative evidence, that not a single article was discovered which could have been attributed to the white man. Several excavations made in other portions of the mound yielded similar results.

Black Hammock. One of the largest shell-heaps on the St. Johns is to be seen here. It is situated on the borders of a large lagoon, on the left bank of the river just above the outlet of Lake Jessup,* and seven miles above Lake Monroe. Besides the principal deposit of shells, there are two smaller ones. At the westerly end is the first, a few inches thick, extending one hundred and fifty feet along the shore, and some thirty or forty feet inland. This is separated from the rest by a small watercourse, the outlet of a morass. The shore then takes a northerly direction for about two hundred feet, and consists entirely of sand; at the point where the shore again takes an east and west direction, is a second but smaller deposit, extending only a few feet to the eastward. One hundred and eighty feet from the point just mentioned is a small burial-mound, and a

* This lake was discovered by Lieutenant Peyton, of the U. S. Army, during the Florida war, and at first bore his name, which ought not to have been discontinued. It were better to preserve the Indian names if they can be learned, but if not, no one has a right to usurp a name which has been given by others in honor of the discoverer.

little more than a hundred feet from this begins the largest of the heaps, which measures about nine hundred feet in length on the river side, and has a breadth varying from one hundred to one hundred and fifty feet. It has been largely undermined, and sections, in some places from three to four feet in thickness, exposed. It is not improbable that originally this and the smaller deposits were continuous, the intervening portion having been washed away by the river. If this were so, the mound could not have been less than twelve hundred feet in length. It is intersected by a small stream near the centre, and is bordered by another at its easterly end, both outlets of small morasses in the rear of the mound.

That the Indians confined their encampments, or, at all events their cooking, almost entirely to these mounds, is proved by the fact, that fragments of pots were picked up in large numbers along the shore wherever the shells are seen in the bank, and, though careful search was made for them, not elsewhere. To make the evidence of the human origin of the whole deposit complete, pits were sunk at different points. One of these, about four feet in diameter, was dug entirely through the shells into the sand beneath, which was reached at the depth of four feet and three inches. Seventy-five fragments of pots and six pieces of the bones of the deer, thirteen of turtles, and two of the alligator were thrown out. These were scattered through the whole thickness of the shell deposit, but not a single specimen was found after the sand was reached. In a second pit of similar size, ninety-seven pieces of pots, six fragments of the bones of the deer, eleven of the turtle, and nine of the alligator were found. The shells found here are chiefly Paludinas, though Unios and Ampullarias are met with.

Old Enterprise is situated on the north-eastern shore of Lake Monroe, and forms a distinct bluff consisting entirely of shells. It has a front of about one hundred and sixty feet on the water side, and at the western end rises some-

what abruptly to the height of fifteen feet above the lake; on the top is a plateau, on which formerly stood a hotel and several out-buildings, and to the eastward the surface falls off by a gradual slope. On this side there is an extensive swamp, separated from the lake by a beach-wall of shells, consisting of the same species as those found in the bluff, and extending several hundred yards along the shore. As there are mingled with these shells the fragments of pots and bones of animals, they were all no doubt derived from the mound, and have been scattered by the action of the water. On the westerly side is a spring discharging highly sulphuretted water, and flowing into the lake through a small morass. The mound extends back from the shore about five hundred feet, but is of a very irregular shape, being much narrowed in its middle, and spreading out again in the rear portion into two unequal and irregular transverse ridges. While on the front the mound is composed of the three kinds of shells, the rest consists almost exclusively of Paludinas. That a large portion of this mound has been destroyed, and that the shore of the lake is receding, is obvious from its abrupt front, the distribution of its material along the shore, and the fact that twelve palmetto trees to the eastward of it are now surrounded by water, and their roots denuded to the depth of from two to three feet.

In consequence of the undermining of the front, and the looseness of the materials, which generally are neither compact or stratified, excavations were easily made. They were continued through several days, many cartloads of material were moved, and collections made from all depths below the surface, of whatever objects were mingled with the shells. These objects consisted of the articles already mentioned in connection with the other localities, and in addition various fragments of worked shells which will be described farther on. Although several arrow-heads and many flakes or "chips" of flint were picked up along the shore, none were actually found in the mound.

Excavations made in the ridges at the rear of this shell-heap did not yield precisely the same, nor so decisive results. The shells, consisting almost entirely of Paludinas, were much more compact, and the objects found in them much fewer. In certain directions there were appearances of somewhat extensive removals of material having been made, but whether by the Indian or the white man, we could not learn.

To the westward of Old Enterprise, which name applies to the bluff just described, is an orange grove, and beyond this an "old-field," which rests upon a thin deposit of shells, distributed somewhat uniformly over the surface. Excavations made here in many places gave the same results as were obtained at the bluff.

Horse Landing is a shell-mound on the right bank of the river a few miles above Pilatka, and eight miles below Lake George; it is three hundred feet in length, one hundred in breadth in the widest part, and rises abruptly in every direction. On the front it shows a vertical wall about eight feet high, giving a good section of its whole structure, the result of the action of the river which here makes a sudden bend. Underneath the shells is a layer of sand rising about four feet above the water, which at the time we visited the locality, was not much below its highest mark. In its general appearance the mound has the aspect of a geological deposit, in consequence of the compactness of the materials, the greater decomposition of these than is seen elsewhere, and above all, from its distinct stratification. The upper portion of the sand on which it rests is more or less mixed with fragments of shells, and still higher are alternate layers of these, and of shells mixed with sand; it is this condition which gives the whole its stratified appearance. At one place six such alternations were counted, but in others they were less numerous. None of the strata extended continuously through the whole length of the mound. Two explanations of this appearance are suggested: first, successive overflows of the river; second, interrupted occupation of the

mound. The first seems quite improbable. The water is not now known to rise above the lowest limit of the shells, nor in fact could it rise much beyond this, since the configuration of East Florida is such, that any unusual flow of water becomes at once spread out over the immense tracts rising only a few inches above the level of the river. Nothing short of subsidence of the land could bring the water to the level of the highest of these strata. The second is the more probable, but in the absence of proof can only stand as a reasonable conjecture.

In view of these facts the search for the evidence of man's work was important, and especially as the mound had the appearance of great age. The whole front, in which all the objects were undisturbed, was therefore most carefully examined, and with the following results: First, excepting within a few inches of the surface and in the vegetable mould, not a fragment of pottery was discovered; second, a few bones of the deer, more or less broken, were found, and one of them burned; those of the soft-shelled turtle, alligator, and gar-pike, as also numerous fragments of charcoal, were obtained at various depths between the top of the mound and the sand on which it rested. If to these we add an ornament made of bone, to be described farther on, we have the scanty evidence derived from the materials, for the conclusion that the mound was built by man. Mr. Peabody, however, made an important discovery which confirms this conclusion. He observed a piece of flint projecting from the sand just beneath and quite near to the lowest deposit of shells. It is to be remembered that in this part of Florida flint does not naturally occur, in fact that there is nothing but sand in which even pebbles are seldom seen. Before the flint was removed, we both carefully examined all the surroundings, and were satisfied that the flint and the sand in which it was imbedded had not been disturbed since the mound was begun. The front of the mound was vertical, the section was recent, and the small talus which forms below it is constantly removed.

Anything once detached is carried away by the current which is here somewhat brisk. When removed, the flint had all the evidence of having been "chipped," and was evidently the result of a rude attempt at an arrow-head. We cannot, therefore, in view of all the facts resist the conclusion that the mound was of human origin.

The only shell-heaps visited by us in which we failed to find satisfactory traces of man, was on the left bank of the river, a few miles below Hawkinsville (formerly Occola). This deposit is one hundred and fifty to two hundred feet in length and eight feet high, has a swamp in the rear from which it rises very abruptly; on the front it has been so much undermined by the river that it presents a nearly vertical face, showing a good section through its whole length. A series of excavations had been made along the summit during the rebellion, for military purposes, so that there were unusually good opportunities for examination. Notwithstanding all this, we failed to find any pottery or other works of man at any point, except within a few inches of the surface. The contrast with Black Hammock and Old Enterprise was very striking. The mound was composed almost entirely of Paludinas, and, in some points, of these mixed with sand, forming a solid conglomeration. In this last we saw fragments of the tibia of a deer, which had been broken in the same manner as the bones from the other shell-heaps. The abruptness with which the mound rose from the level surface on the rear gave it the appearance, and this was the only circumstance which did, of artificial origin.—*To be concluded.*

THE BELTED KINGFISHER.

BY AUGUSTUS FOWLER.

This bird, *Ceryle Alcyon*, perforates the sand or gravel-bank for a breeding-place, preferring a situation near some

stream of water; sometimes, however, they select a place a mile or more distant from their fishing haunts. They will associate with the Sand-martins, and rear their brood in the same bank. Although there is a great difference in the disposition of these two species of birds in the management of their home affairs, as regards neatness and system of living, yet they live amicably together. The Martin, quiet and gentle in her manner, carries on the affairs of her household, which would do credit to many a housewife living in a higher sphere, and of whom domestic economists would do well to take a few lessons in the art of house-keeping. The tenement of the Kingfisher presents quite a different aspect. In it there is no nest of soft dried grass and downy feathers prepared for the nestlings, nor care of any kind for the reception of the eggs, except a cavity hollowed in the form of an oven at the extreme end of the hole, which measures in height from four to five inches, and in depth, below the passage leading to it, about three-fourths of an inch. The passages are usually from thirty to thirty-five inches in length; the first one is straight and about sixteen inches long; the second, which leads to the nest, diverges to the right or left, and is about the same length of the first one. On the bare earth, in the space above described, the female deposits from six to eight pure white eggs, which measure in length one and one-fourth inches, and in breadth one inch. Unlike the mild birds of the bank with whom it has the peaceful privilege of breeding with, it comes with a furious flight, with a fish still quivering in its powerful bill, with crest erect, and with a loud rattling voice, that wakes the echoes, and enters the hole, dividing amongst the brood the food it brings them. It requires but a short time to render the apartment a filthy one; the offal of their food, the excrements of the young birds, and the exhalations of their bodies, produce such a stench as to make it a wonder how they live and thrive in such an offensive place.

The Kingfisher is more cautious when it approaches its nest

before the eggs are hatched than afterwards. During the time the female is laying her eggs, she does not fly directly to her nest, but alights near by on the branch of some tree or prominent object, and raises her head and tail together, and at the same time her crest; she reconnoitres the place for some minutes, and, scanning every object closely, then, if not alarmed, she enters her hole. The entrance to her nest is not round, but in the form of an ellipsis. It is larger, but otherwise similar in shape to that of the Sand-martin. It is astonishing that so great an observer of natural objects as Mr. Audubon should represent the entrance to the nest of the Martin as being round; such a mistake, not being in conformity with the facts in relation to the posture and appearance of the birds he so beautifully delineates, destroys the harmony of his whole picture. The Kingfishers arrive early and prepare their nesting-place; they then lay their eggs, and incubation commences about the tenth of April.

NOTES ON TROPICAL FRUITS.

BY W. T. BRIGHAM.

[Continued from page 311.]

Ananassa (various species),—Pineapple, Ananas. The flavor of tropical fruits raised under glass is almost always inferior, but the pineapple is a marked exception. Perhaps no fruit differs more in quality in its own native land, some fields producing a rich juicy fruit, while the plantations near by yield only a dry insipid produce. Under glass, the golden and ruby cones are almost always good. The best specimens of pines come, it is said, from Guayaquil; but the little island of Niihau, in the Hawaiian group, produces a fruit rich and melting, such as is seldom found in the East Indies. Here they may be eaten as oranges.

The manner of growth is sufficiently familiar. A cluster of stiff, pointed, serrated leaves, two or three feet long, from whose midst rises a stem of about equal height, bearing on its club-shaped extremity a tuft of small leaves, beneath which, on the expanded part of the stem, are the violet, mint-shaped flowers. As the flowers fall off, each one is succeeded by a slight protuberance, and these all swell together, grow juicy, and at last the cone of the perfected fruit remains. The fruit varies in shape from an almost globular to a very acute conical form; a species of the latter form is much cultivated in Peru, and has white flesh, although many prefer a small fruit of dark red color externally, and yellow within. As the pine bears no seeds, it is propagated by cuttings; the crown of leaves, when planted, requires nearly three years to come to maturity, while the offshoots from the base bear in a twelvemonth.

The fruit is eaten raw or cooked, and the juice makes an excellent wine, or may be fermented as beer. A ripe fruit is best eaten by breaking apart the little radiating cones of which it is composed, and sucking each one from the centre outwards. The fibre of the leaves is most beautiful and silky, and is used largely in making the piña cloth. A field of wild pines, such as cover many of the islands in the Straits of Malacca, is almost as rough and inaccessible as a field of cacti, and the sharp stiff leaves are formidable weapons to the bare legs of invaders; but the bright fruit, peeping out here and there all through the wilderness of spines, is quite sufficient to attract gatherers. At night, as the land-breezes sweep down over these islands, they take with them the exquisite fragrance to comfort the poor sailors who may have spent the day in scratching their bodies and tearing their clothes in getting pines.

As an ornamental plant, the pine presides with queenly state in the beautiful Botanical Gardens at Singapore, and its huge golden yellow fruit, often fifteen inches long and seven to ten in diameter, might well look down in contempt

on the wretched specimens of its race thrown upon our wharves.

Tacca pinnatifida,—Arrowroot, pia. Of the many plants which produce the starch known as arrowroot, the tacca is the most important in the Pacific Ocean. On the Hawaiian Islands it grows wild, and its tuberous roots are much sought after. The plant is low, conspicuous only from its deeply cleft horizontal leaves, above which rises in the proper season a cluster of greenish flowers. The tubers are shaped like potatoes, and so far as known are never eaten raw, being quite acrid, although by no means so poisonous as the manihot.

Musa (various species),—Banana, Plantain. The best and most important of all tropical fruits, found in the tropics of every continent, and universally cherished by the people whose meat it is. Every one would know a banana at sight, and yet the pictures of the plant, even in our best text-books, are very faulty. One of the common geographies represent it as bearing two bunches of fruit; another, as having a distinct stem.

When the cutting or shoot is planted (and it requires a deep rich earth and much moisture to grow in perfection), it soon sends up two leaves, tightly rolled together, until the green roll has grown some two or three feet, when the blades unroll and become most tempting food for cattle of all sorts. These leaves are followed by others until the stems of the leaves have formed a smooth trunk some eight or ten inches thick, and sheathed by the drying or dried remains of the earlier leaves. At the end of nine months a deep purple bud appears in the centre of the leaves, and its constantly lengthening stem pushes it out beyond the leafy envelopes, and it hangs down heavily like a huge heart. Now along the stem are seen little protuberances in rows, extending perhaps two-thirds of the way around the stem, and as the great purple envelopes of the bud fall off, these are seen to be

little fruits, each with a waxen blossom and huge projecting stigma at the end. These are the female flowers farthest from the end of the stem, while as successive purple leaves fall off (you may see the scars they leave on any bunch of bananas), the male flowers are seen in closer rows and of the same waxen yellow color. The flowers are full of a good honey. Three or four months are required to ripen the fruit, and in the mean time the bunch of male flowers has withered and dropped away, and the ovaries of the female blossoms have swollen into bananas, it may be a foot long, and the huge bunch hangs down scarcely supported by the now withering stem. The fruit is ripe, and the banana has done its work, and, if left alone, soon dries up and dies. From its base spring up shoots which may be transplanted. If the stem is cut down to the ground as soon as the fruit is gathered, the round bulbous rootstock sends up new leaves, and a second plant matures much sooner than do the offshoots.

Although most banana bunches hang down in maturity, a kind is found on the Society Islands, whence it has been introduced to the Hawaiian, whose very large bunches of deep orange-colored fruit stand up erect, forming ornamental rather than useful objects; for their taste, even when cooked, is exceedingly disagreeable and acrid. The Brazilian banana, so-called (and no attempt is made to give here the correct names, as the nomenclature is hopelessly confused in different countries, and the bold writer who should attempt to write a monograph of this genus, would need all his courage), is tall, rising to a height of fifteen, or even twenty feet, and the fruit is yellow and excellent, rather vinous in flavor; these are the long yellow bananas common in our markets. The Chinese banana seldom exceeds five feet in height, the leaves are of a silvery hue, and the fruit quite aromatic. The Fei, or Tahitian banana, is similar to the Brazilian but not so tall, and the fruit is angular, yellow, turning black when fully ripe, and the flesh is salmon-col-

ored or buff, and slightly acid. Then there are varieties with red fruit quite common here, blunt fruit, and some with a very diminutive fruit of fine flavor. The names Banana and Plantain are used almost indiscriminately, but the latter usually applies to those varieties which are coarser and usually eaten cooked.

Usually no seeds are found within the pulp, but at Akyab, and along the coast of Arracan, a kind is found full of seeds. These seeds are black, rough, about the size of cotton-seeds, and enveloped in a sort of fibre so that they cannot be readily cleaned. The taste of this variety is very inferior.

The Spaniards have a curious superstition about the fruit. The cross section presents a rude cross, and from this they suppose the banana was the forbidden fruit, and Adam saw, in eating it, the mystery of redemption by the cross. The cross is not very distinct, and the excellent Padre Labat remarks, after mentioning this belief: "There is nothing impossible in this; Adam may have had better eyesight than we, or the cross was better shaped in the bananas which grew in his garden."

The ways of eating bananas are almost innumerable. Raw, they are eaten by themselves, or cut in slices with sugar and cream, or wine and orange juice. Cooked when green or ripe, they are fried alone or in batter, baked with the skin on, made into a pudding much resembling an apple dumpling, or baked in pies. They may be cut in strips and dried, or pounded into a paste and dried; in the latter form they are the staple food of many Mexican tribes. The amount of nourishment is very great, and Humboldt's statement is often quoted, that the same extent of land which produces one thousand pounds of potatoes, bears forty-four thousand pounds of bananas; a surface bearing wheat enough to feed one man, will, when planted with bananas, feed twenty-five. Lucky the people who can eat bananas, and leave the potatoes for the hogs!

The young shoots are cooked as greens, but the stem and

old leaves are full of a watery acrid juice, which stains white cloth an indelible black or dark brown. The fibres of the leaves make a textile fabric of great beauty, known as a fine kind of grass cloth.

In cultivation the plants are set closely, the Chinese banana requiring only three or four feet between the rows, and the clusters are gathered before they are quite ripe, and hung up in some cool place, or better still, buried in the earth. Some bananas are certainly improved by this premature gathering, but others are much better when ripened in the natural way. The prices on the Isthmus of Panama, and at most tropical ports, varies from a real (12½ cts.) to a dollar, according to the size of a bunch and the season of the year. The prices asked in the Boston market are simply outrageous, and our fruit-dealers let the fruit rot in their windows rather than lower the price.

A plantation will yield all the year round by timing the planting, but the crop is much more abundant at one season. The care the plants require is little enough if they are planted by a brook or in moist ground, and the bunches of fruit may weigh eighty, or even more than a hundred pounds when ripe.

The geographical limits of the banana are much more extensive than those of the cocoanut, and extend even beyond the tropics.

DIRECTIONS FOR COLLECTING LAND AND FRESH-WATER SHELLS.

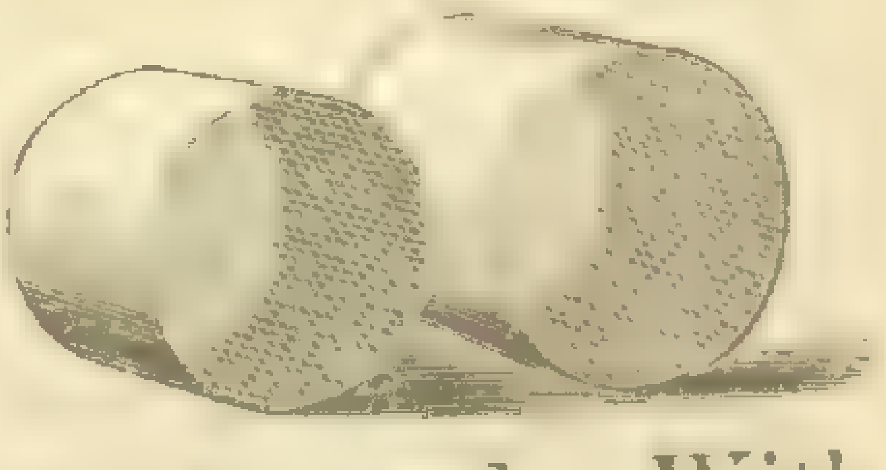
BY JAMES LEWIS, M. D.

If the collector is provided with suitable apparatus for gathering certain classes of shells, his work is more than half done when he has *found* them. This is especially true of land shells. The apparatus needed for these is simply

a tin canister, of sufficient size to hold all that may be secured at one time of species as large as *Helix monodon*, or larger. A large wide-mouthed bottle may answer the same purpose. The canister should have an easy fitting cover perforated for ventilation. The cork to the bottle may be perforated. For species less than *H. monodon* (one-third inch diameter), a bottle of alcohol that may be carried in the vest pocket will be desirable. The larger species are picked up by hand without any aids. The small species are often so fragile and so minute that a pair of delicate pliers, some like the light pliers used by watchmakers, but having wider blades, will be found so useful as to be indispensable. With the pliers the small shells can be rapidly picked up and conveyed to the alcohol. The use of the alcohol is to contract the soft parts to the smallest dimensions, by extracting the water they contain. It leaves the shells in a cleaner condition than when they are allowed to crawl over and cover each other with mucus and dirt. If it be desired to preserve specimens of those mollusks that are destitute of shells for anatomical purposes, they should have a separate bottle of alcohol to keep their mucus from enveloping the shells of small species.

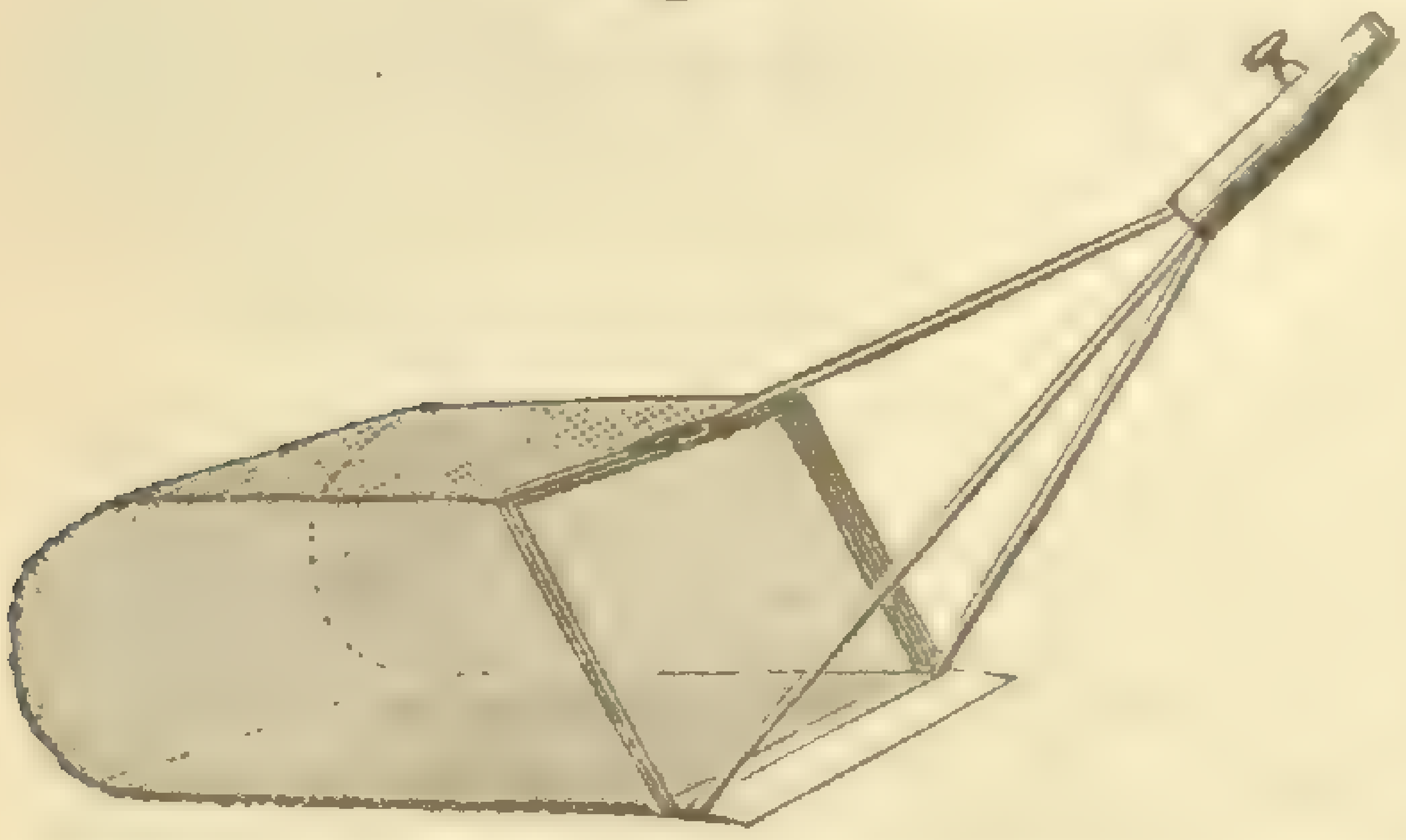
To collect fresh-water shells the collector needs sometimes only his hands, especially in narrow rivulets where everything can be seen and reached from either side of the water. He needs a bucket of water for larger species,—a bottle of alcohol for minute species that would be likely to become lost or broken by association with the larger. Usually only a bucket of water is needed. For all those classes that crawl on or burrow in mud, some sort of *dredge* is needed. The simplest device that can be suggested is a tin dipper (Fig. 1), the handle of which may be made of any convenient length by adding thereto a light wooden rod. With a finely perforated instrument thus arranged, a film of mud with shells intermingled may be scraped up, the mud sifted

Fig. 1.



out, the shells remaining. The shells may be emptied into the bucket of water, and the dredging continued as long as desirable. For more rapid progress in collecting, a net made of iron wire-gauze, of about twelve to sixteen wires to the linear inch, is very useful (Fig. 2). The gauze may be stretched over a stiff metallic frame, so arranged as to form a bag, the mouth of which is about eight inches by four, with a depth of about eight inches. The net should be fixed at an angle of 45° with the handle.

Fig. 2.



The outer margin (at the mouth of the bag) should have a sharp metallic edge like a hoe. A long handle is necessary; one that may be separated into parts, each about three or four feet long is most convenient, on account of the facility of adapting the length of the handle to the depth of the water, or to the position from which the collector has to work.

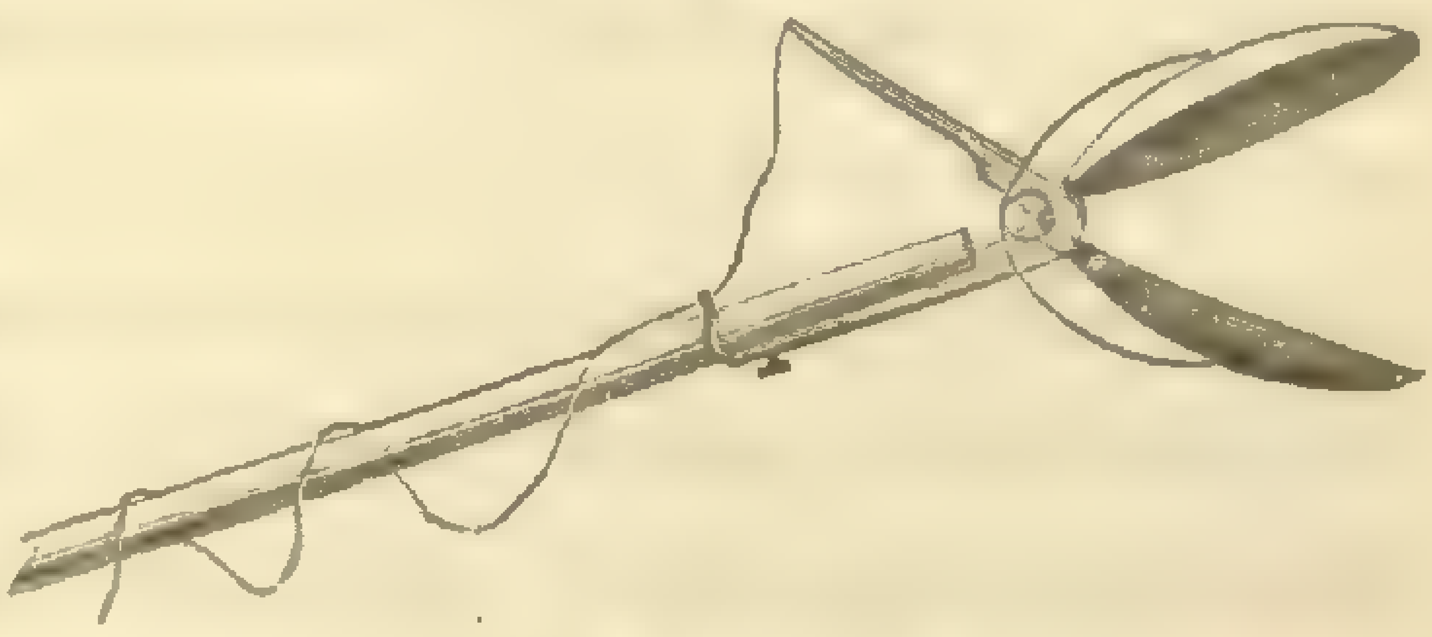
With a properly arranged apparatus of this kind, nearly all the small univalve and bivalve aquatic species may be secured with more readiness and in greater abundance than by other means. The shells that cannot be so readily obtained in this way are the fresh-water limpets (*Ancylus* and *Gundlachia*), which have to be taken by the slow process of removing them simply from the stems of plants or surfaces of stones to which they adhere, by sliding a knife-blade under them.

Many small species of fresh-water mussels (*Unionidæ*), such as are sometimes found abundantly in some of the Southern and Western rivers, are often readily attainable by means of the net. By proper manipulation the net may be made to scrape up a thin or thick slice of mud with the shells that mingle with it. Then reversing the net in the water, mouth upward, the sand and fine mud are sifted out, care

being taken not to fracture fragile shells, or break the brittle margins of univalves by too violent shaking. Shells that adhere to flat smooth rocks may be taken expeditiously with the net.

To take Uniones, the collector will succeed best in shallow water by wading. Long rubber boots are desirable for this work; also, a pair of metallic tongs (Fig. 3), the handle of one blade lengthened by a wooden rod, to be held by one hand to direct the instrument in its work, while the other hand pulls a cord that causes the other blade to close on the specimens to be taken. A basket carried on the arm serves to hold the specimens, which should be handled carefully.

Fig. 3.



An iron garden rake may sometimes be used with much advantage to uncover species where the current will wash away the turbid water. When the water is cleared, the shells may be seen and can be picked up by means of the tongs, net, or dipper, or even with the rake, if not too small. In lakes and ponds, where the bottom is muddy and the Uniones can be seen from a boat, the dipper, used so as not to make the water turbid, will answer the purpose. If the bottom is gravel the tongs may be used. In deep dark water in rivers, Uniones are sometimes drawn ashore in seines used for fishing. They have also been secured by means of rakes.

It often happens that there are small mollusks that feed on aquatic plants, and can seldom be found elsewhere. This is the case in lakes and in rivers that have only a moderate current. Such species will seldom be obtained with either net or dipper, and the collector will be obliged to content himself with slower processes. By carefully lifting the weeds out of the water the little mollusks may be found on the stems and leaves. They very usually detach themselves when disturbed, but if they are once fairly above the water,

very few are lost, for the reason that they continue to adhere to the wet weeds by capilarity. The pliers will be needed to pick them off and transfer them to the bottle of alcohol.

Preparation and Preservation of Specimens.—Land-shells and the larger aquatic univalves are generally cleaned, after boiling them a few minutes to detach the soft parts, by means of a little hook with which to remove the soft parts, a tooth-brush to wash the shell externally, and a syringe with which to rinse the interior of the shell. Sometimes the interior has also to be wiped out with a bit of cotton wound on a splinter of wood. The more perfectly a specimen is cleaned the more agreeable is its appearance. If portions of the soft parts remain in the shell the offensive odor of decomposition remains a long time. In the preparation of *Paludina* it is desirable to secure the opercle of each specimen in the shell to which it belongs, by means of thick mucilage. Some species of *Melanidæ* that have peculiarly formed opercles should receive similar attention. The larger species of *Sphærium* may have the soft parts removed, and the valves tied shut to dry. The smaller bivalves will dry if spread on paper in a moderately cool place with a free circulation of air, only a few of the shells gaping. If exposed to the sun they are very apt to open. Small shells like *Amnicola*, *Bythinella*, *Valvata*, etc., may be quickly dried in the sun after having been in alcohol twenty-four hours. The same remarks apply to some land-shells, such as the smaller *Helices*, *Pupa*, *Vertigo*, *Carychium*, etc. *Vitrina*, if carefully managed, may have the soft parts removed after boiling, or after having been in alcohol twenty-four hours. Cleaned and rinsed, the shells are exceedingly beautiful. But dried in the manner too often witnessed, they are not a very attractive addition to a collection of well-selected specimens. In the treatment of *Succinea*, either boiling, or twenty-four hours in alcohol, will answer, preparatory to the removal of soft parts.

Some mollusks, the shells of which are thin and transpa-

rent, when prepared for the cabinet simply by drying the soft parts, can never be made to have that brilliancy that is seen in a carefully cleaned specimen. By the side of well-cleaned specimens they are so inferior in their appearance, that when the collector has once had an opportunity to compare them, he will never be content with indifferently cleaned specimens. *Physa hypnorum* is a species to which these remarks will apply. It is, however, a very difficult species to clean perfectly on account of the persistence with which the soft parts adhere within the apical whorls. But by an adroit expedient this difficulty may be overcome. After the shells have been boiled a few moments, take each specimen up singly, and hold the apex a few seconds against the blaze of a lamp or candle. Soon a small quantity of steam forms with a slight explosion that loosens the soft parts perfectly. A jet of water from a syringe will then remove the soft parts and rinse the shell at one operation. *Physa hypnorum* may be kept in alcohol several months until partial decomposition has begun. Then with a powerful jet of water from a very small syringe, the soft parts may be instantly and wholly removed. The same modes of treatment may also be applied to other species. Shells kept long in alcohol, however, are liable to become stained. *Lymnæa gracilis* permits the soft parts to be removed with the utmost ease and certainty by boiling or by the alcoholic treatment. *Ancylus* is very easily prepared after having been in alcohol. Indeed most of the specimens treated with alcohol will be found with the soft parts detached after a few days.

Uniones (fresh-water mussels) require to be cut open with a knife to divide the muscles, after which the soft parts should be carefully removed, leaving no traces of them to stain the shell. An easier and more expeditious mode is to boil them, when the muscular attachments are destroyed, and the soft parts are ready to drop out. After the soft parts are removed the shells need to be rinsed clean, and before the hinge-ligament gets dry the valves should be tied

shut, taking care to preserve perfect every part of the shell, not forgetting even the epidermal fringe. Specimens that have had the soft parts removed by cutting, are usually more brilliant than if boiled, or if the soft parts are simply macerated or dried.

Rare specimens of *Unionidæ* are sometimes found where the musk-rat has accumulated shells. It is sometimes an object with the collector to preserve shells found only under such circumstances. Such specimens when carefully washed will often be found to have a dull chalky appearance that is not indicative of the true character of the species. The brilliancy of the shell may be measurably restored by dipping it a few seconds in a bath of *dilute muriatic* or *nitric acid*, then rinsing with clear water and wiping dry.

Since naturalists have come to regard a collection according to the *perfection* of the specimens it includes, the habits that collectors were accustomed to indulge, in their attempt to beautify specimens, have pretty much gone out of use. It is no longer considered necessary to remove the epidermis of shells in order to develop unrevealed beauties, except perhaps in specimens intended to adorn a mere collection of curiosities. Even *varnish*, which once was so liberally applied to shells to impart a fictitious gloss, is now no longer used by those who aim to serve the purposes of science. Yet there are some circumstances under which a somewhat defective specimen may have its *natural* appearance partly restored, even when apparently of little value. After cleaning the shell carefully with a brush, moisten the whole surface with a dilute solution of gum arabic, wiping off the surplus. The gum when dry takes the place of the albuminoid tissues that have been dissolved out of the surfaces of the shell, measurably restoring its natural appearance.

Young collectors are often annoyed, after they have taken much pains to prepare fine specimens of *Anodonta* and some thin-shelled *Uniones*, to find that their specimens crack when dry, sometimes falling in pieces. This difficulty may be

avoided by dipping fresh specimens into a solution of *chloride of calcium*,—a hygrometric salt that always retains enough moisture to remain in solution under ordinary conditions of atmosphere and temperature. This salt may be prepared by neutralizing *hydrochloric* (or *muriatic*) *acid* with chalk.

The use of *varnishes*, *oils*, *glycerine*, etc., on shells is not recommended. A very thin solution of *gum arabic* has this advantage,—that if found objectionable it may be readily washed off without detriment to the most fragile specimen. From the general tenor of the preceding remarks on collecting, it will be understood that *perfect specimens* are above all others the most desirable. Such, usually, can be obtained only by securing them alive. When a species is abundant and the collector has obtained a large series of specimens, he will be able to select those which best represent its character. It is, perhaps, policy to return the younger and imperfect specimens to the station from which they were taken, as by so doing the species may continue with only slight diminution of numbers.

The collector is urged to avail himself of *opportunity* on all occasions to secure species, however abundant or undesirable they may seem to be at the moment. Many mollusks are noted for appearing in abundance for a brief period, then disappearing for a number of years. Sometimes artificial influences destroy a locality that produces abundant specimens of desirable species. The erection of a mill, or some chemical establishment on a stream, sometimes kills out many of the mollusks it would otherwise continue to produce. Tanneries, asheries, saw-mills, dye-houses, in fact all kinds of manufacturing establishments on streams interfere with the mollusks and other forms of life inhabiting them.

Incidentally, the collector of shells will unavoidably have his attention drawn to many other forms of life while seeking mollusks. Scarcely any of these will be so insignificant

that they may not deserve passing notice. While collecting land-shells, opportunities are often presented for securing specimens of valuable species of insects, crustaceans, and worms, especially rare and curious species of beetles and centipedes, whose habits necessarily lead them to seek shelter and concealment with the larger snails. The *chrysalides* of various species of *Lepidoptera* are also found in similar situations, and may be secured and preserved as a means of obtaining more perfect specimens of the mature insects than can be obtained by hunting the insects themselves. Various species of *Salamanders* (or "lizards," as they are often termed for want of a more appropriate name) may also be found in the damp grounds where snails seek shelter under logs, etc.

In searching for aquatic mollusks, many rare species of fish of small size, such as are just suited for the aquarium, will often be found and captured with the mollusks. Stagnant waters are rich in various forms of insect life, and some of the species are remarkably interesting for their singular forms and curious habits. In such situations will be found both the *larvæ* and perfect insect of several species of *Dytiscus* and allied genera, some of the species quite large, others quite small. Such stagnant waters also produce various other kinds of insects (see Vol. I, p. 328, fig. 2; p. 436, fig. 2), including those that *swim* and *skate* (Vol. I, p. 328, fig. 3) about over the surface of the water as well also as those that propel themselves boat-like *in* the water (Vol. I, p. 328, fig. 1). A limited class of *crustaceans* and *annelids* are found in similar stations,—all of them objects of curious interest, not less on account of the singularity of their forms than on account of the wonderful habits that disclose their adaptation to the conditions in which they are found.

To the microscopist, also, the stagnant water offers a world for investigation (Vol. I, plate 13, illustrates some of the forms). A little tuft of the green slimy vegetation that in such situations is found adhering to sticks, twigs, in

fact every surface covered by the water, is full of life in some of its most singular and wonderful forms, some vegetable, some animal (Vol. I, pp. 505 to 530 inclusive; also 587 to 595).

The stagnant pool is also the winter residence of numerous species of frogs and other *Batrachians*, for whose songs we listen in the warm showery evenings of the opening spring. Hither come also the wanderers in the fields and forests to deposit their eggs, which appear first endowed with life as minute *pollywogs* or *tadpoles*, ultimating in toads and frogs. The eft, or water-newt, a small brown *salamander*, marked with curious spots, is also found in the stagnant waters; and pools, on the borders of marshes, are the homes of various species of turtles. The larvæ of mosquitoes, of which our country has a great variety of species, abound in stagnant waters, and they will be readily found in every little puddle that has been a few days exposed to the sun's warming influence.

In the streams where there is greater purity of water, insect life is not so apparent. But here we have the curious cray-fish (*Astacus Bartonii* of the older writers) that in miniature apes the form of his marine cousin, the lobster. Here abound the larvæ of various species of dragon-fly (Vol. I, p. 279, fig. 5; Plate 9, fig. 1 to 7; p. 307, fig. 1; pp. 308, 309, 311) in somewhat greater abundance than in the crowded stagnant waters,—also the *larvæ* of various species of Caddis-flies (*Phryganea*), who form for their protection little tubes composed of fragments of wood, straws, etc., connected together by the silken secretion of the young insect. In rivers and lakes on the stems of aquatic plants, in June and July, will be found beneath the surface of the water numerous *pupæ* of a beautiful beetle, the mature insects glistening with burnished steel and bronze, flitting about and sunning themselves on the aquatic vegetation.

Life abounds around us everywhere. To call attention to a few forms that do not daily challenge familiar attention

has been the object of this paper. The subject is one full of interest,—one that has received the attention of the most vigorous intellects, and yet remains as full of undiscovered truths as in the beginning,—being, as are all the works of nature, a field of infinite variety, inexhaustible.

A COMICAL OWL.

BY CHARLES WRIGHT.

THE owl is called a solemn bird. It may be so; yet I have seen one in Cuba whose actions would upset the gravity of a very sober meeting.

The bird in question (*Glaucidium Siju* Orbigny) was taken young from the nest, and grew quite tame and familiar. His ordinary food consisted of lizards, though he would eat moths and other large insects. His power of swallowing was surprising. From the first, almost, he could dispose of the smaller lizards; but soon gained strength and throat capacity to take in specimens as long, if not quite so large, as himself; even two, three, or more at a meal. He usually commenced by tearing away, awhile, at the head, which, however, he did not seem to diminish much in size; after which came the effort, sometimes a protracted one, to swallow it entire—head foremost. With time, however, it took its regular supper (it had but one meal a day) with little apparent effort, unless an uncommonly large bit was given him. And so much did his appetite increase, that sometimes a scarcity prevailed; whether it occurred from the neglect of the negrito to cater faithfully, or from the paucity of the game. By day, he remained, solemnly, in the corridor, dosing away the lonely hours on a pigeon-cage, or on the beam supporting the eaves. Before learning to fly well, at night, after candle-lighting, he was taken down and placed

on the table to take his supper. Afterwards came the fun; and this consisted of actions, if not so dangerous, queerer than that ascribed to the one which continued to look at the man going round the tree till it twisted its neck off. He was curious to examine everything he saw in motion. If a moth scorched its wings and fell on the table, he would sidle round it till satisfied there was no danger to be feared, when he would seize it, if of a size to *be* seized, or make at least the *effort*, if too small, and, if hungry, devour it; or leave it to examine some new object. What, however, was particularly amusing was his observation of minute insects which were attracted to the light, and, of course, fell, unable to fly, but with power to struggle. And his vision was so acute, that he saw, instantly, across the table even, any new comer, though too minute to be readily seen by the spectators without a lens. Now he would approach the helpless sufferer, at first cautiously, as if taking roundings. Meanwhile he would stretch his neck upwards to its utmost extent and look directly down; then first to one side, now to the other, and twist his head round so that the eyes would be almost downwards and the beak upwards; all the time, sideling one way, then the other, till, at last, reassured, he would make a little leap, and pounce down upon—nothing.

"Sijuito" had other odd ways. His tail was not so large nor so brilliant as the peacock's. Perhaps he thought it was, which was just as well for him. At all events, he did his best to display what he had, as well as the more splendid bird. He spread it out to its utmost extent, cocked it up as high as it would go, and twisted it to the left and to the right, uttering, frequently, his monotonous *toot*.

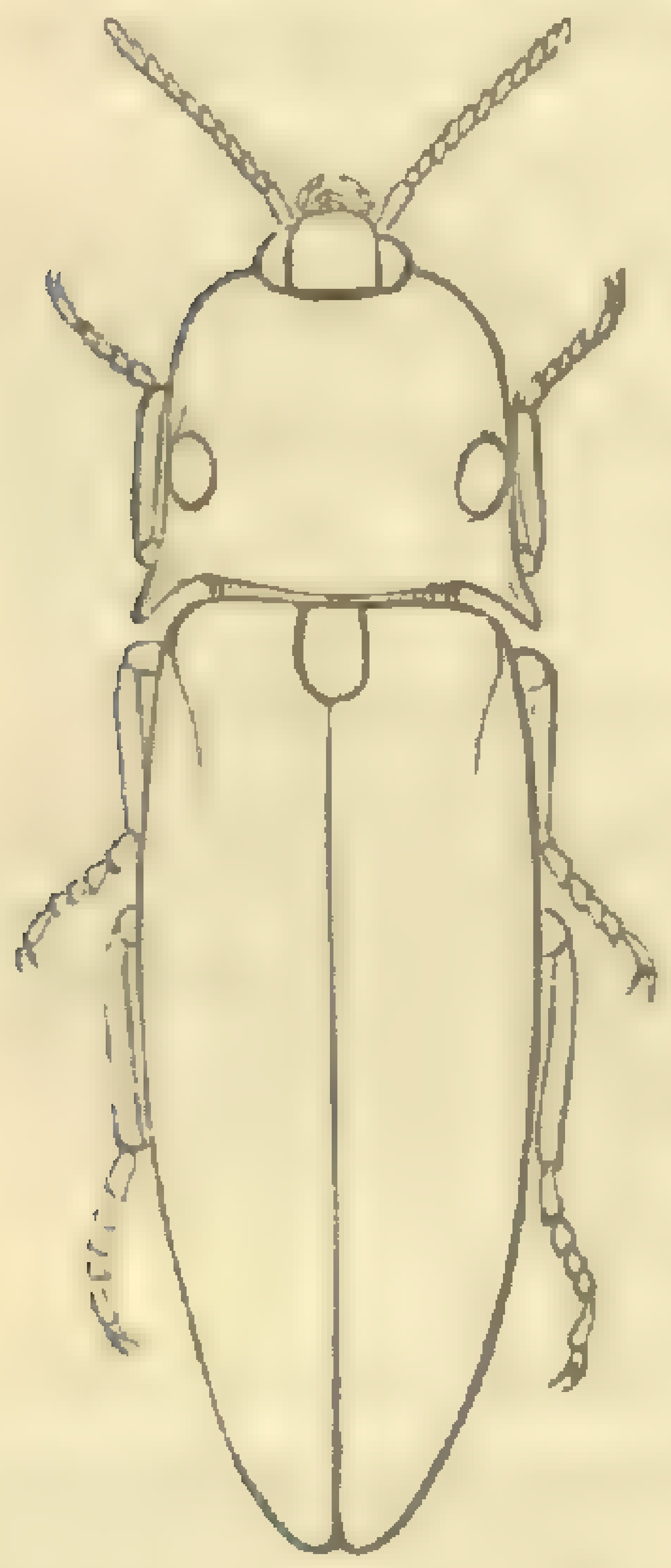
If one could have followed in "Gundlach's" tracks, and stopped at all his stopping-places, he would have found that bird in a greater number of attitudes, and all natural ones, than would be practicable with hardly any other, unless it were a parrot; inverted positions being reckoned among the number.

Our little owl became, at last, venturesome, wishing to see the great outside world; and, flying out of his safe domicil one night, he passed too near the cat, when the worthless beast killed the funny bird.

THE CUCUYO; OR, WEST INDIAN FIRE BEETLE.

BY G. A. PERKINS, M. D.

BUT few of the many thousands of organized beings that cover the earth are endowed with the power of becoming



luminous, and it is because their number is so limited, and consequently that they fall so seldom under our observation, that our wonder is so great upon beholding them. About fifty of all the animals (if we except the Acalephs, or Jelly-fishes) are possessed of this power of shining. Thirty-four of these belong to the insects; and a large portion of these insects belong to one genus, the *Elaters*, or snapping-beetles, some of which we find about our gardens in summer, though our species are not luminous.

The only light-bearing insects found in our own locality are of other genera, *Photuris*, etc.; this is the little fire-fly which we find in damp fields or pastures on hot summer nights. It is the male of this insect only that flies: the female is wingless and but seldom seen; when found, however, her light proves to be very much brighter than that of her more active companions; this wingless female is the glowworm. The larva which closely resembles the female is also luminous, and even the eggs are said to be slightly so. We all remember these little sparkling fire-flies, and the queer thoughts that often pass through our brains on

first beholding them. How many times have we chased them, hat in hand, just at dusk in a warm summer's evening, and thought we were quite sure of our prize, when the next moment he was sparkling high in the air above our heads; and when, after many unsuccessful trials, we were so fortunate as to secure one of them, how have we feared to take the little harmless creatures in our fingers, lest we should be burnt; or how, when their light was temporarily extinguished, did we puff and blow, as if we had a live coal, to brighten them up again, so natural is the connection, even in the mind of childhood, of light with heat.

This feeling of wonder, and a desire to know somewhat more of so strange a phenomena, is not confined to children alone. Older and wiser heads have shared it too. The chemist, anatomist, and physiologist have each, by their peculiar method of investigation, endeavored to obtain an answer to the question, How do animals shine? Nor is it strange that after all their efforts, they should fail to obtain a clear solution of the difficulty. The chemist looks for phosphorus, a well-known constituent of the bodies of all, or nearly all, animals, but finds but little of that element in proportion to the amount of light evolved. Slow combustion is tried with a like unsatisfactory result. The physiologist looks for some sort of galvanic action, like that of the gymnotus or torpedo. The anatomist, with perhaps no preconceived notions on the subject, makes his careful dissections in hope that some arrangement of parts, undiscovered before, may reward his search and solve the problem; but still we fail to be satisfied. We must, therefore, believe that while the Great Lawgiver, in this as well as in other natural laws, employs means for the accomplishment of the end designed,—the production of light,—yet that these means bear no analogy to others intended to effect the same result, though under very different circumstances. The luminosity in animals is a power peculiar in itself, as truly and distinctly so as seeing, hearing, muscular contraction, or the exercise of any other power or

faculty with which animals are endowed by the Creator; and this phenomenon is produced by an act of volition of the animal, through the nervous power acting on a peculiar fatty matter, found only in certain portions of the body: or it may be that some of the brain masses, or ganglia, are specially appropriated to this particular end, and that there need be nothing peculiar in the fatty mass upon which its power is expended.

At the head of the list of light-giving creatures, and far exceeding them all in the amount and intensity of its phosphorescence, stands the West Indian Fire Beetle, called by the people of the islands, Cucuyo; by naturalists they are known as the *Elater* (Pyrophorus) *noctilucus*, or Night-lighting Elater. Though found in all the West Indian islands, the sugar plantations of Cuba are their paradise, and during the warm evenings of the rainy season they exhibit themselves to perfection. An amusing account of the method of capturing these beetles in olden times is found in the Naturalist's Library, which I copy for the amusement of the reader.

"Whoso wanteth Cucuij," says Pietro Martire, in his Decades of the New World, "goeth out of the house in the first twilight of the night, carrying a burning fire-brande in his hande, and ascendeth the next hillock, that the cucuij may see it, and hee swingeth the fire-brande about, calling cucuius aloud and beateth the ayre with often calling and crying out *cucuie, cucuie*. Many simple people suppose that the cucuij, delighted with the noise, come flying and flocking together to the bellowing sound of him that calleth them, for they come with a speedy and headlong course; but I rather thinke that the cucuij make haste to the brightness of the fire-brande, because swarms of gnattes fly into every light which the cucuij eat in the very ayre, as the martletts and swallowes doe. Some cucuius sometimes followeth the fire-brande, and lighteth on the grounde; then he is easily taken, as travellers may take a beetle if they have need thereof walking with his wings shut. In sport and merriment, or to

the intent to terrify such as are affrayed of every shadow, they say that many wanton wild fellowes sometimes rubbed their faces by night with the flesh of a cucuius, being killed, with purpose to meet their neighbors with a flaming countenance, as with us wanton young men, putting a gaping vizard over their face, endeavor to terrify children or women who are easily frighted."

By the kindness of a friend* I am now in possession of a thriving family of these strangely beautiful beetles, numbering over forty, of all sizes; and while I write, they are shining in all their brilliancy just by my side. Considerable care and attention is necessary to keep them in health. They are soon to have their supper, which consists of sugar-cane, cut into thin strips and moistened with weak syrup, which they suck, or rather lick, up with an evident relish. They present a singular appearance, ranged in rows upon the bottom of a plate, each with his mouth applied to the strip of cane. As soon as they have finished their meal, they are to take a bath for their health and comfort; for, like children who indulge in sweets, they get pretty thoroughly daubed, and need a good washing. This bath of tepid water seems to arouse all their light-giving energy, for while feeding the light is extinguished (very economical, surely!). The basin in which they float is all aglow; it is indeed a magnificent spectacle which I wish all your readers could share with me. The water seems to possess the same luminous property as the insects, and resembles, when seen at night, a basin of liquid gold.

As to size, form, and general appearance, the cut at the head of this article gives a good idea. It has been drawn by Mr. Emerton with his characteristic faithfulness from a full-grown insect. In color they are of a dark brown, almost black; the larger ones have a rusty appearance, from the presence of short brown hairs on parts of the back. They have nothing peculiarly attractive but their power of giving

* Mr. F. Margollis, of this city.

light. The spots, from which issue the luminosity, are not situated upon the head, as most persons suppose on seeing them, but upon the sides of the thorax, or middle portion of the body, and also from a spot on the abdomen just below the insertion of the last pair of legs, where the abdomen and thorax join. This abdominal spot is not so frequently seen to be illuminated as the spots on the thorax, but when the insect is about to fly, or when, by accident, it gets upon its back, this part gives out light of tenfold intensity. The side lights are oval and convex, standing out laterally, and are hard and horny externally; but this is only a very thin and transparent protection to the luminous matter that fills them. When not shining, they are of a dirty white or light-brown color.

They are really lanterns, and, as such, serve to light the insect on his nocturnal rambles. It is worthy of notice that these lanterns are so placed that the light from them never enters the eye of the beetle directly, but only when reflected from surrounding objects; in fact, they are placed just as we place lanterns upon our carriages, and for the same reason, that the light may not shine into the eyes of the driver to dazzle and confound him, but only upon objects before and around him, from contact with which he might be in danger. This light also serves to attract their friends, as I have had occasion to notice while a number of them were upon the wing together in a dark room. While flying, their light seemed to arouse their companions, who soon joined them, and we enjoyed the rare sight, at least in this region of the globe, of seeing several of these flying about my room at one time; they seemed to play as flies do during the hot days of summer. When preparing for flight, they appear quite restless, and climb upon the highest part of whatever they may happen to be upon, often the thumb, when held in the hand; their side lights glowing with great brilliancy, but surpassed by the spot beneath; the elytra, or hard horny cases that cover their gauze-like wings, now swing upon their hinges.

and, with a whirr, the insect starts off like a rocket. No power of description can convey a true idea of this singular sight, the tiny spark of our little fire-fly appearing like nothing in comparison; and this light is continued while they are in motion, and not intermitting like our own fire-fly. Their flight did not last many minutes (ages of torture to nervous ladies who might happen to be in the room!!), being often brought to an end by the insect flying against the mirror or window curtain, and falling to the floor; sometimes they would fly around one of the beetles which I held in my hand, and alight quite near it.

Beginning their gambols just as the daylight fades away, they keep in an active state for about two or three hours, when they become quiet, moving but little, and ceasing in a great measure to give forth light. I have often noticed this cessation of light just after a period of excitement, and also just before they were to make an attempt to fly,—the power of the nervous system seeming to exhaust itself by its vigorous exercise, requiring rest afterward, or else they rest to concentrate their energies for greater exertions.

Being "birds of night" they remain dormant during the day, hidden in the damp leaves or herbage, looking as if dead, but being full of life and activity as night draws on. I have endeavored to cheat them by taking them into a darkened room during the day, but the attempt was not successful, they still remained quiet until the usual hour; and when disturbed by rough treatment and placed near a window, they invariably crawled towards the darker parts of the room. One of my colony, by some mishap, got one of its side lanterns out of repair so that it emitted no light for two days, but after that time perfectly regained it. Most of the little pets seem to have met with the loss of one or more legs, and some have lost all; but this mutilation does not seem to interfere with their luminous powers at all. These poor cripples have to be assisted more than their companions when taking their food.

The light given off by this insect is of a very peculiar nature. When seen during the day it is of yellow color, strongly tinged with green; at night the green is not perceptible, and the amount of light given off, though considerable, is of an *intangible* character. I use the word intangible, for want of a better one, to describe the opalescent appearance of their lights when we look directly at them. Its effect upon the retina of the eye is, at times, painful when looked upon steadily for some minutes; and after being shut up in a dark room with them for an hour or even less, I have found, upon looking at the gas-light in the street, it had a brilliant red appearance, as intense as the crimson stars of rockets made by the burning of strontian. This effect lasted several minutes.

By placing the luminous parts of one insect quite near the paper, very fine print can be easily read by its aid, though I cannot imagine the light, even of a large number, to be sufficient for any *practical* illuminating purposes as has been affirmed by some writers. The Cuban ladies make a singular use of these living gems, sewing them in lace bags, which are disposed as ornaments upon their dresses, or arranged as a fillet for their hair.

The perfect control which the insect has over these luminous spots is very marked. While they remain dormant during the day, their light is wholly extinguished, not even a ray is then to be seen even in the darkest room; but as soon as they begin to crawl, that moment they light up their path with the lanterns on the thorax, not often using the patch upon the abdomen, except while flying or preparing for flight, and it is only while on the wing that their whole illuminating apparatus is displayed in all its intensity and beauty.

Their period of perfect insect life, even in their own native island, is quite brief, lasting only about three or four months, not one being seen before the commencement of the rainy season, which begins about April, and disappearing in July.

or August. As this period draws to a close, they lose much of their vigor, their power of illumination grows less, even their bath fails to arouse them, and it wholly ceases just before death takes place.

The treatment which I have found to be most successful in keeping them in health, is that which imitates as nearly as possible their condition in their own climate. There they feed upon the sweet juices of the cane which they find accidentally bruised (for they have no organs for wounding the plant), being frequently drenched by the warm tropical showers, flying about briskly for a few hours only during the early evening, and hiding under the dark damp foliage during the day. And to give them, as nearly as possible, the same conditions, I bathe them with tepid water, feed them on weak syrup upon slices of cane, giving them their food in the evening, and, during the day keep them in an open-work basket, covered with fresh damp clover-leaves.

In my collection were insects of various sizes, but I was not able to perceive that the smaller ones gained any in size, though they ate well. Being perfect insects, it is doubtful if they require much nourishment, but only a sufficient amount of moisture to make good the loss by respiration and transpiration; the sugar, perhaps, giving it a relish, or, it may be, keeping up the fatty matter of the illuminating organs. I have never found the least trace of excrementitious matter about them. As the period of their life during which they feed most freely is confined to the larva stage, like other insects, it is only during this time that they increase in size. I find no mention in any work of the nature of the food of the larvæ of this particular species of Elater; but some of their cousins are said to be very destructive to the roots of plants, particularly of the grasses.

An examination of the peculiar matter upon which their power of luminosity depends, or in which it manifests itself, shows it to be composed, in a very large portion, of fat, in which are found some air-tubes and a very large supply of

nerves. This fatty matter is of a chalky whiteness, and, when spread upon a slip of glass and examined by the microscope, gives the characteristic appearance of fat globules. When rubbed upon paper and warmed, it leaves a greasy stain; and when the whole mass is digested in sulphuric ether, the fat is dissolved out, leaving branch-like masses of nerves in great abundance, and also the tubes of the air-vessels. The mass of luminous matter upon the abdomen is, as has been stated, many times greater than that upon the thorax, and is covered externally by a very delicate and flexible membrane, which forms the joint, and reaches completely across the animal. Inside it has not so distinct a boundary, the vessels of other portions of the body being continuous with it, the luminous matter still being quite distinct. In the thorax, this same substance is found lying behind the two oval, convex, transparent membranes, of a horny nature, being separated from it by a very thin transparent membrane, which acts as a special envelope, and is also supplied with nerves and air-tubes, as in the abdominal portion.

It becomes very evident to any one who attentively examines these insects while in a living and healthy state, that their luminous power depends, not upon chemical action, as does the air in our lungs during respiration, which action must go on entirely independent of any voluntary effort on the part of the possessor, but that it is completely under the control of the animal, and is used by it for purposes which render its exercise at times wholly needless. It is also evident that whatever arouses the nervous energy of the animal to full activity, causes a corresponding manifestation of luminosity; and, on the contrary, whenever the insect is placed in media which depress its vital powers, and act either directly or indirectly upon its nervous masses, then it ceases, wholly or in part, to give out its light, using it as means to accomplish a desired end, as truly as its muscular power.

In concluding this paper, already unnecessarily long, I

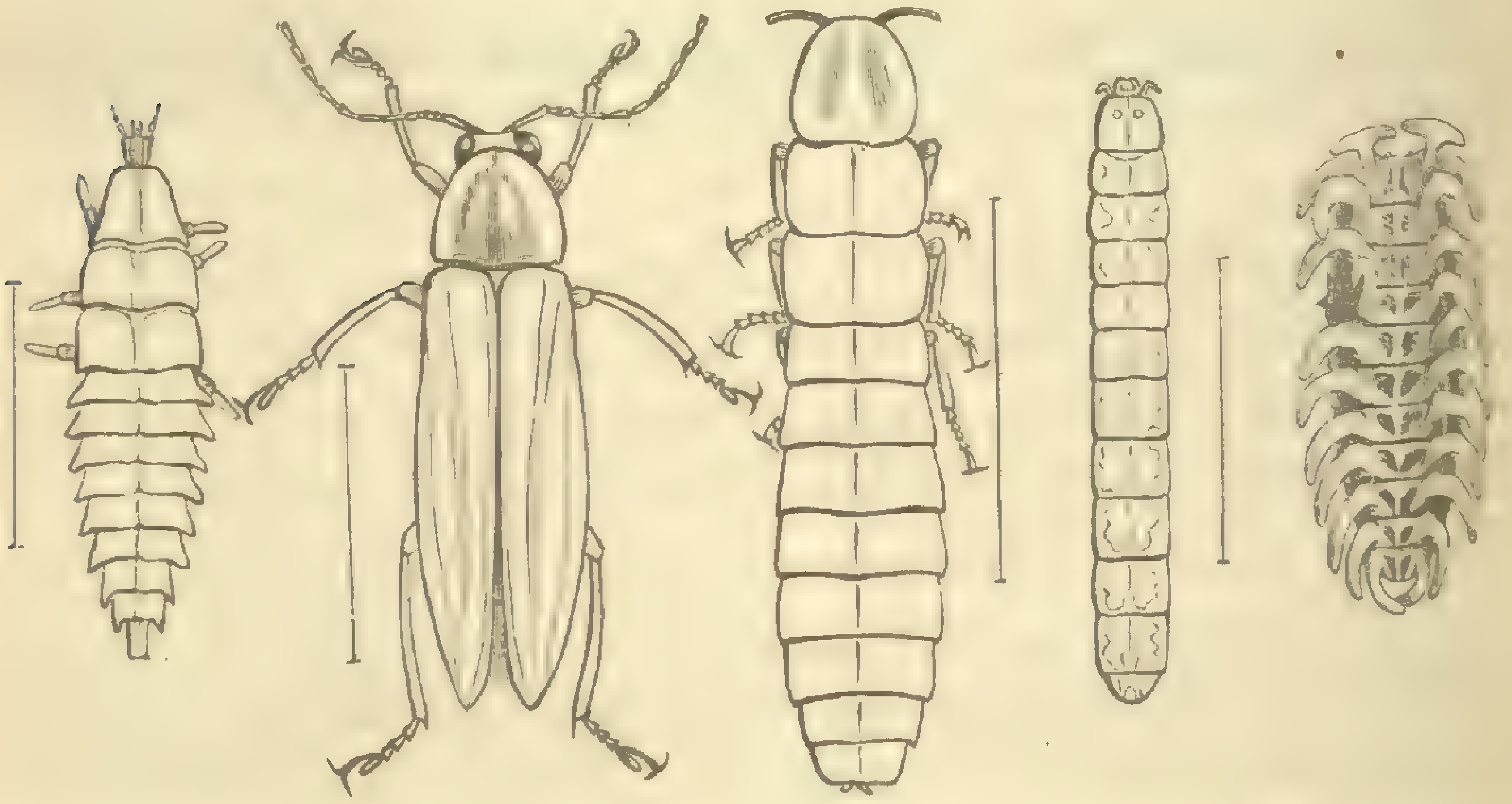
cannot omit to give the reader an extract from a letter from Cuba which I have just met with, by a most pleasing writer,* which gives a vivid description of this insect as seen in its native island. The writer, after a most amusing account of several insects with which she (?) came in contact, says:

"But a really beautiful and interesting insect is the Cocuyo, or famous fire-fly of the West Indies, two of which I now have on my table in an impromptu cage, where they have been domesticated for a week. Very docile are they in my hands, to whose touch they seem to have become pleasantly accustomed, taking kindly to a diet of moist sugar in lieu of sugar-cane, which is their appropriate aliment, and accepting a semi-daily bath in my wash-basin with great apparent enjoyment, floating about in the water for several minutes, and then spreading their legs and feelers as a sign that they are ready to come out. They are a sufficiently unattractive bug in their unilluminated state, being of a dingy earth-brown color, and about the shape and size of a large cockroach; but they become so glorified by the irradiation of those wondrous orbs of phosphorescent light which they carry about on their shoulders, that the children scream with delight at the sight of them, and ladies make pets of them as I do, and even use them as ornaments, on some occasions. I saw a lady at the 'Retreta' once, with a coronet and stomacher of them; and all the crown jewels of Spain could not have made her so resplendent. The light is not a flash, seen for a moment and then gone, like our firefly, but it is emitted in a brilliant, steady ray, at will, and is of extreme beauty of tint, being of a slightly greenish yellow viewed in some positions, and of pale red viewed in others. It is a touching fact, that the poorer classes, when severe sickness visits their dwellings, confine a half-dozen of the Cucuyos in a cage, and are thus furnished with a most beautiful and inexpensive light for night-watchings."

*W. M. L. Jay, in "The Churchman" of June 13, 1868.

It is to be hoped that, with the modern facilities for short passages from Cuba, we shall every year be able to see, even in our frigid climate, a large number of these distinguished strangers.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.



NOTE.—We figure several examples of our native fire-flies, with a figure (Fig. 3) of an adult female glowworm from Zanzibar, which closely resembles the English glowworm (Lampyris). Fig. 1 is, very probably, the larva of a genus allied to *Photuris*, of which *P. Pensylvanica* (Fig. 2) is the adult male, enlarged twice, as are the other figures (the lines by the side of the figure shows the length of the insect itself). We found this larva early in May, under a stone in damp ground, at Swampscot, Mass. It is represented as in the act of walking, the feet on one side of the body moving alternately with those on the other. This is the way insects generally walk. It was not luminous on the evening of the day it was discovered. But a truly luminous larva (Fig. 4) has been communicated to us by Mr. Sanborn; it was found at Roxbury, Mass. We have been as yet unable to refer it to its proper genus and species. Fig. 5 pictures a most singular larva, belonging evidently to this family, and related to the genus *Drilus*. It was found by Rev. E. C. Bolles, at Westbrook, Maine, under leaves, and it, probably, like other larvæ of fire-flies, feeds on land snails, etc. The body of this remarkable insect is very flat, so that it looks as if there could be no room for the viscera. On opening the box, it remained stationary for so long a time, that we thought we had before us the dead and dried remains of an insect, which puzzled us exceedingly as it was, but more, when it slowly moved before our astonished vision. To talk of an insect winking its eye is a heresy, but we imagine there must have been an involuntary twinkle in its mind's eye at our innocent surprise at its movements. Here, indeed, was one of those forms so often observed

by naturalists, which mimic other objects for purposes of self-protection. Our comical larva has, doubtless, had many a laugh over the balked research of its carnivorous foes, for it so strongly resembles a dead and withered leaf with its edges variously incised and turned up, as to escape any but the sharp eyes of our conchological friend. As seen in the figure, the sides of the head and each ring of the body is produced into a remarkably long, soft, fleshy tubercle, and there are two rows of black spots along the back. The figure is drawn over twice the natural size.

In the "American Entomologist" (noticed in our Reviews) are drawings showing the transformations of another genus of fire-fly, the *Photinus pyralis*. The larva feeds on soft-bodied insects, probably the earthworm, and, when full-grown, forms an oval cavity in the earth, where it transforms into a pupa, and in ten days assumes the beetle state. — Eds.

REVIEWS.

The Percheron Horse.* — We cannot notice this work better than by quoting the following short preface of the translator:

"The little volume which is now presented to the notice of the lovers of the horse in America is a translation of the work of a distinguished French author, who, holding a high position of trust, made this as a report to the Government. His views in some respects may be regarded as extreme, but on the whole they are characterized by strong common sense, and are supported by a practical familiarity with all the phases of his subject which should give them weight.

The Percheron horse, no doubt, stands first among the draft-breeds of the World. His value has been thoroughly tested in this country, and the fact is established beyond a cavil, that with careful breeding, and probably an occasional renewal by the importation of fresh blood, the Percheron maintains his superior characteristics, and impresses them upon his descendants of only one-quarter or one-eighth blood to a very marked degree. The value of fast trotters, their encouragement by Agricultural Societies, and the enormous prices which have been paid for animals valuable simply for their speed as trotters, has, no doubt, had a tendency to direct the aims of horse-breeders in a wrong direction. The result is, from whatever cause it comes, that the true horse-of-all-work has been neglected. The Percheron, combining as he does a certain attractiveness of style, very free action, considerable speed united to power, with astonishing strength for his weight, and the greatest kindness and docility, seems to offer to American horse-breeders an exceedingly useful animal, either to be maintained distinct, or used for improving our stock of both light and heavy draft-horses by crossings. The value of this work, however, does not consist in its recommendation of this breed, or demonstration of its value in France, but its bold discussions of the principles of breeding as applied to the improvement of the Percherons, and equally applicable to that of other draft breeds, will, doubtless, commend themselves to the careful consideration of breeders.

Interest in the Percherons has increased greatly of late. Several notable importations have been made, and excellent representatives of this noble breed are to be found in the Eastern, Western, and Middle States. The engravings which embellish this volume are portraits of animals owned by Mr. W. T. Walters of Baltimore, Md., through whose interest in this subject the Publishers were induced to issue this translation of M. Huys' work."

The following remarks by M. Du Huys, on the Arab as the *Primitive*

*The Percheron Horse. Translated from the French of Du Huys. Illustrated. 12mo, 1868. Orange Judd & Co., New York.

Horse, and his relation to the Percheron, will not be uninteresting to our readers:

"I commence with the Arab crossing. Two motives have induced me to follow this classification:

1st. The Arabian is the type-horse, and the type should be examined before its derivatives.

2nd. The Percheron shows a very great analogy, by his coat, conformation, character of race, mild disposition and endurance, to the Arab, of which he seems to be the son, notwithstanding certain differences, the result of time, climate, and the region in which he is bred and in which he lives.

I have said that the Percheron horse exhibits in common with the Arab numerous marks of a common parentage and relationship: these marks are very obvious. A Percheron, a true Percheron, for some still exist (as the famous *Toulouse* of M. Cheradame, of Ecouche: and the renowned *Jean-le-Blanc* of M. Miard, of Villers, near Sap, in the department of the Orne, etc., etc.), placed alongside of an Arab, presents, notwithstanding his heavier and grosser form, analogies with him so striking that we are easily induced to believe them undoubted relations.

The Percheron of the primitive type has a gray coat like the Arab; and like him an abundant and silky mane, a fine skin, and a large, prominent, and expressive eye; a broad forehead, dilated nostrils, and a full and deep chest, although, the girt with him, as with the Arab, is always lacking in fulness; more bony and leaner limbs, and less covered with hair than those of other draft-horse families.

He has not, it is true, the fine haunch and fine form of the shoulder, nor that swan-like neck which distinguishes the Arab; but it must not be forgotten that for ages he has been employed for draft purposes, and these habits have imparted to his bony frame an anatomical structure, a combination of levers adapted to the work he is called upon to perform. He has not, I also acknowledge, such a fine skin as the Arab, nor his prettily rounded, oval, and small foot; but we must remember the fact that he lives under a cold climate, upon elevated plains, where nature gives him for a covering a thicker skin and a warmer coat, and that he has been for ages stepping upon a moist, clayey soil.

In all that remains in him, we recognize a heavy Arab, modified and remodelled by climate and peculiar circumstances. He has remained mild and laborious, like his sire; he is brought up like him, in the midst of the family, and, like him, he possesses in a very high degree the faculty of easy acclimation. He acquires this in the midst of the numerous migrations he accomplishes in Perche, the counterpart of those that the type-horse makes upon the sands of the desert. A final comparison, which has not, as yet, been sufficiently noticed, is, that, like the Arab, he has no need of being mutilated in order to be trained, managed and kept without danger. In a word, the Percheron, notwithstanding the ages which separate them, presents an affinity as close as possible with the primitive horse, which is the Arab.

From this similarity of form and probable relationship, comes the thought of new alliances. But in order to form a more easy estimate of their effects, it will not be without interest to classify the horses with reference to their origin. This classification produces three very distinct groups: the primitive horse, the natural horse, and the compound horse.

The *Primitive Horse*, oriental in its origin, is the pure Arabian horse; no other is acknowledged.

During the time of the crusaders, as we have already said in our first part, in consequence of wars and all kinds of excursions, individuals of this race were spread over almost all parts of the globe. Although at first the prestige which their superior merits deserved led to their being bred in-and-in, these exiles were placed under different latitudes, in different atmospheric and hygienic conditions, which gradually modified their qualities and led to the degeneracy of the race. And it became more or less degenerate in proportion as the soil upon which the colts were foaled was colder, poorer, and more inhospitable; *for the horse is as much, and more, the son of the soil upon which he is foaled and reared as he is of his sire and dam.*

This fact has no need of proof. We see it every day before our eyes in studying at home the changes that our French breeds themselves undergo when transported from one province to another. It might, however, be thought that these new latitudes, these new regions, would differ but little from those in which they lived.

The first change that the primitive horse undergoes, from the difference of the regions into which he has been transplanted, being due to nature itself, we call the result the *Natural Horse*. Here it is proper to remark how wise nature always is. If it modify the primitive horse for the worse, it modifies him, however, under conditions better adapted to his wants. In rendering him more puny, it renders him more temperate, and enables him to live and to nourish himself upon the food that the locality is able to furnish. Submitted to the trials and the

fatigues of war, and to all the miseries in its train, the natural horse, badly built, ungainly and puny as he is, endures fatigue almost as well as the primitive horse.

The *Cross-bred Horse* is, as his name indicates, the issue of a sire and dam of different breeds. This crossing, made with a view to improvement, may give, when judicious, more elegant, better made, and finer bodied progeny and also quicker in their various gaits, but always requiring, especially if derived from the English, exceptional care, and so much the more particular as they are of a more *distingue* nature.

Abandoned to himself, deprived of blankets, shelter, grooming, and oats, the cross-bred deteriorates early, and in war perishes miserably, while the natural and the primitive horse thrives in browsing upon the scantiest herbage. On this score, our two campaigns of the Crimea and Italy have furnished unquestionable proofs."

American Deer.* — In this paper Mr. Caton gives us much interesting and valuable information on the habits, anatomy, and physiology of the Elk (*Cervus Canadensis*), and the Deer (*Cervus Virginianus*). As the author's account is the result of personal observations and experiments, made with great care on a herd of about sixty deer and twenty-one elk, kept in his extensive parks for the last six or eight years, his little pamphlet will be invaluable to any one following in this study. Several new points in the physiology of the deer and elk are brought out, and many popular errors corrected. The supposition that a buck attains a new prong to his horns every year, is shown not to be the fact, as young bucks often have more "points" than old ones. He also gives much valuable information on the shedding and growth of the horns in both species, and a careful account of the different stages in the growth of the coats of hair and fur. He describes the deer as shedding its coat twice a year, and appearing in a red and a blue coat, while the elk sheds its hair but once. We would like to make many extracts from Mr. Caton's paper, but space will not allow, and we must refer the reader to the pamphlet itself.

Catalogue of the Phænogamous Plants of the United States, East of the Mississippi, and of the Vascular Cryptogamous Plants of North America, North of Mexico. Compiled, arranged, and published by *Mr. H. Mann*, of Cambridge. The species are all numbered, and we find that there are 3,646 Flowering Plants known in our territory, east of the Mississippi, while but 178 of the higher Cryptogams occur in all North America, a smaller proportion we are inclined to think than will be found on any other continent.

We believe the catalogue was published with special reference to the convenience of botanists who might wish to make exchanges, and for this purpose it will be an invaluable aid, but every one interested in our flora should have a copy of it at hand, as at once the most convenient and most comprehensive thing of the kind ever issued in the country.

The Publisher will send it to any address in the United States, upon the receipt of the price (25 cts).

The Canadian Entomologist. — We have received the first number of this new enterprise, issued at Toronto, August 1, 1868, in 8vo size, at 50 cents a volume. It is to contain original papers on Canadian Entomol-

*American Cervus. By Hon. John D. Caton. Pamph., 8vo, 1868. From the Transactions of the Ottawa (Ill.) Academy of Natural Sciences.

ogy; the transactions of the Entomological Society of Canada; accounts of the capture of new or rare species in Canada, lists of specimens for exchange, and desiderata, by members; and correspondence, etc.

The present number, consisting of eight pages, contains an account of a luminous larva, by Rev. C. J. S. Bethune, and the first of a series of valuable papers on the transformations of butterflies and moths by W. Saunders: the present number giving a detailed history of *Polyommatus Americanus*, our common coppery butterfly; of *Arctia Parthenos*, and *Drasteria erecthea*. The Canadian Entomologist deserves a wide circulation and generous support from entomologists.

THE AMERICAN ENTOMOLOGIST.* — We gladly hail the appearance of this new monthly, which merits a wide circulation among farmers, gardeners, and horticulturists, as well as entomologists, to whom it promises each month to bring new facts regarding the habits of our insects. We have no doubt of its entire success. The study of insects is a practical subject of the highest importance to a people whose main dependence is on the soil.

The Editors, in their salutatory, insist on the importance for agriculturists, of a good practical knowledge of insects. They state, and we believe with reason, that "the United States suffer from the depredations of noxious insects to the annual amount of *three hundred millions of dollars*." By a diligent study of the habits and forms of these insects, their ravages may be greatly stayed, and, as the Editors compute, a million and a half dollars be annually saved to the country. Indeed each state in the Union should have a salaried entomologist. Massachusetts led off in publishing the three editions of Harris's Treatise on Injurious Insects, though the author received compensation barely covering the cost of the paper which he used and the time spent in reading the proofs, but the State never created the office of State Entomologist, though more money has been, perhaps, appropriated for entomological purposes by this State (the third edition of Harris' work costing some $10,000) than any other in the Union. For twenty years the State of New York has had a State Entomologist (Dr. Asa Fitch), whose reports, like that of Dr. Harris, have been a credit to the author, an honor to the State, and a valuable contribution to American science.† New Jersey has had for several years a State Entomologist, Dr. J. P. Trimble, whose work on the Insects Injurious to the Apple-tree was not, we believe, published at the State expense. Within two years the State of

* The American Entomologist, Vol. I, No. 1. Published monthly by R. P. Studley & Co., 104 Olive street, St. Louis, Mo. One dollar per annum in advance. Editors: B. D. Walsh and C. V. Riley. 8vo, double columns, pp. 20, with original illustrations on wood (nine excellent ones in the present number), and one colored lithographic plate in each volume.

† Mr. Walsh states, that "at a recent public meeting of the New York Agricultural Society, Senator A. B. Dickinson gave it as his deliberate opinion, that the writings of Dr. Fitch had saved annually to the single State of New York, the large sum of fifty thousand dollars; and, so far as appears from the record, not a single dissenting voice was raised against this most remarkable assertion."

Illinois appointed Mr. Walsh Acting State Entomologist, and that gentleman has published his first report on the Injurious Insects of Illinois, containing facts of great value to the farmers and gardeners of the West. Mr. Riley has been appointed State Entomologist of Missouri, and it is not yet time for his report to appear. Entomologists residing in other states, have at various times, published entomological articles in the yearly State Agricultural Reports. But the public are beginning to realize that the results of the labors of scientific men, freely given for the good of the country, deserve, and should receive, some remuneration. A pittance given from the public treasury to aid in the researches of the naturalist, the chemist, or the physicist, we venture to say, will prove, sooner or later, a safe investment.

Our readers will find the present number of the "American Entomologist" a very readable one, and we advise them to send for it. Mr. Walsh believes that the Seventeen-year Locust never stings, in which opinion we concur, but he farther suggests that the severe sting said to be made by this, to man, harmless insect, is made by the great *Stizus*, a burrowing wasp, which stings and paralyses the locust with which it provisions its nest, and might sting any person "that stands in their way." He also relates the interesting habits of *Anthophora sponsa*, a solitary Mason-bee; the habits of any species of this genus not having before been observed in this country. The Plum Curculio is said by Mr. Hull to attack the peach-tree, making the well-known crescent-cut in the bark, in which their eggs are deposited in June. They also sting the peaches, but the larvæ growing from the eggs die, the peach withering when falling on naked ploughed land. Mr. Walsh verifies these statements, and gives us an account of the Hull "Curculio-catcher." An account, well illustrated, of a new Bark-louse on the Osage orange, with notes on the Cotton-worm of the South, Grasshoppers, Fire-flies, etc., etc., and Answers to Correspondents closes this promising number.

NATURAL HISTORY MISCELLANY.

BOTANY.

Cross Fertilization.—A plant has just blossomed in the Cambridge Botanical Garden, which shows so plainly a design to effect cross-fertilization, that a brief account of it cannot fail to be interesting.

It is a *Posoqueria*—one of the immense natural order of Rubiaceæ; a native probably of Central or South America: the particular locality whence our plant came being unknown. This individual is a shrub about two feet high, and the flowers, in a cluster at the tips of the branches, are white (or the tube towards the base greenish) and about five inches

long, terminated by a five-parted border less than two inches across. The tube is slender, and around its mouth is a finely-cut fringe of the same color and texture as the border itself, and on its inside are scattering hair-like glands. The flowers are horizontal or slightly drooping, and are very sweet-scented; nor do they thus attract insects without having already prepared a store of honey to reward them for their visits. But the entrance to the tube *seems* guarded. Before the flower opened, the upper part, or limb, or border, was about egg-shaped and bent somewhat downwards. After expansion, the anthers are seen cohering in a mass, nearly opposite the mouth of the tube. The five filaments which support the anthers are of unequal length; the upper lateral — as I propose to call them — being sensibly longer than the lowermost and the lower-lateral pair. Hence, so long as the anthers cohere, the longer filaments must be curved. If they had bent directly forwards, they would nearly or quite cover the orifice of the tube; but they curve laterally and downwards, thus leaving it open. The filaments are very elastic, or, better perhaps, have a strongly contractile tissue on their inner surface, or an expansive one on the outer. The flower is very sweet-scented, and has honey at the bottom. But it is so far away that no insect but such as has a very long sucker can reach it. A large crepuscular moth can do it, perhaps. These moths fly swiftly — with force enough to touch off the spring gun set for them. A light pressure on the tip of the anther-mass causes it to fly apart, scattering the pollen all about, and to a considerable distance. The explosion is caused by the elasticity of the filaments above described, and the object is plainly to deposit the pollen on the breast of the insect, that it may be conveyed to other flowers. In the explosion the lower filament has sprung upwards and now lies close over the mouth of the tube, while the other four are bent sideways, the anthers of each pair still cohering. The insect, even if not scared at such trifles as the shot which greets him, can now no longer continue his feast, but goes away, with his breast bepowdered, to another flower, on whose stigma some of the powder is deposited.

But now we are met by a difficulty. We do not know if there exists a flower whose stigma projects outside of it. We *do* know that the stigma of the flower which shot him is nearly half-way to the bottom of it, inside the tube. Perhaps some of the pollen is on his sucker and may thus be borne to the stigma.

It is well known that this family of plants has many species which are dimorphous, as we call them; some flowers having long stamens and short or imperfect styles, others having long styles and short or imperfect stamens. These last generally produce all the good seeds; or at least more or better seeds than the former. Such is probably the case here; but, as I said, we do not know that it is so. In the native country of our plant there may be others with long styles. If, however, the style is always so short, we may still believe that a portion of the pollen (and it seems to need but little) is conveyed by the sucker of the moth to some

other flower, and thus the seeds become perfected. But if the lower stamen remained in the position it assumed at the time of the explosion, no insect could thrust its proboscis down the tube. So, after a time, the stamen rises and bends gradually back to its original position, leaving free access to insects ever afterwards.

We have an account of a plant whose flower looks, in every particular, like ours, and whose action is the same, except that the separation of the anthers was not produced by pressure on their tips, but by the irritation of the filaments near them.

In the twenty-fourth volume of the Botanische Zeitung, for the year 1866, on pages 129 and following, is a narration, by Fritz Müller, of numerous and varied experiments made by him on a plant, which he calls *Martha fragrans*, found on the island Santa Catarina, near the Brazilian coast, at a place called Desterro. He gives a figure of the flower, and if he had made it from one of ours, he could not have made it more like them; only that he makes no mention of the hairs on the inside, and he says the stigma is twisted, which was not the case in our plant. According to his observations, the lower and lower-lateral filaments could be rudely handled without effect; yet the lightest touch on the inner curvature of the upper filaments near the anthers produced an immediate explosion. Unfortunately all our flowers but one had fallen before my attention was drawn to Mr. Müller's account; and, even then, by a misunderstanding in reading German, in which I am not proficient, I mistook the precise spot where, according to him, the sensitiveness resides. I tickled faithfully, however, the filaments towards their base, without any satisfactory result.

Mr. Müller gives his views briefly thus: A moth, on thrusting its proboscis into the tube of the flower, will very surely touch one of the filaments and produce a discharge of the pollen. It will then go to another flower and convey some of the pollen to its stigma. And he, as it seems, did not *know* whether or not there are flowers with a projecting stigma.

His account and explanation are not quite satisfactory. It seems difficult to believe that in his plants the very simple mechanical mode of explosion could have existed and have escaped his observation. It seems equally difficult to believe that the two plants are not identical. There are, besides, objections to his view. There is nothing to prevent an ant, or a fly, or any other small insect, from causing a useless discharge of the pollen, according to his view and experiments, whereas it is quite plain that such small insects could never convey the pollen to the stigma, if, as in our plant, and apparently in those experimented on by him, it is deep within the tube. There is also another objection to his view. The curvature of the upper filaments form a circle of much larger diameter than the mouth of the tube, so that, it appears to me, it would be the merest accident that the sucker of the moth should touch a filament unless he swayed very much to one side. According to the experiments made here, the moth—a swift-flying heavy insect—comes to the flower

with momentum more than sufficient to cause the discharge of the pollen upon himself. In the other view, the influence, whatever it may be, must be conveyed along the filament to the anther; and, *how* it produces its effect there is equally mysterious. Mr. Müller did not ascertain by what means the anthers are made to cohere. However it may be, a simple mechanical force in the case of our plant sufficed to break up the cohesion; and I can hardly doubt that the true solution is the same in the case of Mr. Müller's plants, and that it was by the merest accident that he did not discover it.

These remarks, it is hoped, will serve to direct attention to the plant in future. It is quite likely it may exist in other gardens in this country, and, if not, there can hardly fail to be specimens of it in European conservatories.—CHARLES WRIGHT.

THE ONION PLANT, so called, is a singular bulb cultivated for the graceful habit of its long sheathing leaves tapering to a narrow point. It is the *Ornithogalum alliaceum* of the gardens, and employed to decorate pedestals in artistical collections of plants; the bulb is of a lively green color and grows upon the surface of the earth, sustained in an erect position by its fibrous roots only. A specimen has lately blossomed in this city, throwing up a spike of small greenish white flowers, at the top of a cylindrical stem of three feet in length. The magnifying glass, when applied to the flower, reveals its real beauty, every part of which is of a crystalline vesicular appearance. Similar to it, but blossoming when destitute of leaves, is the *Scilla maritima*, which, after more than two years careful cultivation, suddenly threw up a tall green stem supporting numerous small white flowers, the petals of which are completely recurved or bent backwards, the flowers in little clusters. It was brought to Salem from some part of Africa, and has been cultivated by F. Putnam, in his conservatory on Crombie street.

Some large fine looking bulbs of *Pancratum Illyricum?* have been liberally distributed by sale, at an extraordinarily low price per bulb. It is a native of the South of France and Spain; the flowers are white, handsome, and very fragrant.—J. L. R., *Salem*.

THE SMALLEST FLOWERING-PLANT KNOWN.—Two weeks ago, returning from the Catskill Mountain House, I saw by the roadside, a mile west of Catskill Village, a pool completely *covered* with WOLFFIA. I hastily seized a newspaper (the only means of conveyance at hand), covered its sides with the minute grains, and keeping the paper wet, safely deposited it in my aquarium. This day (August 22d) I find it splendidly in flower, the little white points dotting my aquarium. This is noteworthy, as being the first found in flower in this country, of this, the smallest flowering-plant known.

P. S.—At the same time are in bloom in my aquarium, *Lemna minor*, *L. perpusilla*, and *L. minor* var. *purpurea*, whose flowers differ so much from *L. minor*, that Mr. Leggett, who gave me these, will propose it as a distinct species.—T. F. ALLEN, M. D., *New York*.

PLANERA AQUATICA, THE PLANER-TREE.—Botanists of the South and South-west would confer a favor and benefit, if they would send to Professor Gray, of Cambridge, good specimens, in flower and fruit, of this rare tree; also, a stock of the fresh ripe fruit from which the tree may be raised. There are very few good specimens extant in the principal herbaria, and the tree is nearly or quite lost from cultivation, so far as we can learn, both in Europe and in this country. The monographer of the Ulmaceæ, for DeCandolles' Prodromus, particularly needs specimens at an early date.—A. GRAY.

VIOLA ROTUNDIFOLIA.—This plant was found in bloom April 23, in the vicinity of New Bedford, growing in mossy hummocks, in a rather dry, open place. The plant must be rare near the coast in this latitude, as it is not given in any of the local catalogues (Bigelow, Irving, Olney, Hitchcock, etc.) as occurring so near it.—H. W.

ZOÖLOGY.

HATCHING THE COTALPA LANIGERA.—Up to the time of writing the article on page 186 of the NATURALIST, we had not succeeded in getting the eggs of the Goldsmith Beetle. On the evening of the 13th June last, we caught in the drug-store, Keyport, whither they were attracted by the profusion of light, four Cotalpas, representing both sexes. These were taken home and well cared for. On the 16th a pair coupled. A jar of earth was at once provided, and the beetles placed on top of the dirt. In the evening the female burrowed and disappeared. Near midnight, she had not returned to the surface; next morning she had reappeared. The earth was then very carefully taken from the jar, and, as removed, was inspected with a glass of wide field but low power. Fourteen eggs were found; not laid (as we expected) in one spot, or group, but singly, and at different depths. I was surprised at their great size. Laid lengthwise, end touching end, two eggs measured very nearly $\frac{3}{16}$ of an inch. They were like white wax, semi-translucent; in form, long-ovoid, and perfectly symmetrical. On the 13th of July one had hatched; the grub was well formed and very lively. Its dimensions were about $\frac{5}{16}$ of an inch in length, and about $\frac{3}{30}$ of an inch in thickness. It was a dull white, the head-plate precisely that dull yellow seen in the adult grub, the legs the same color, and the extremity of the abdomen, lead-color, the skin being transparent. For food, a sod of white clover (*trifolium repens*) was given them, roots downward, knowing that the young larvæ would come upward to eat. They were then left undisturbed until August 19th, when the sod was removed, and it was found that the grubs had eaten into it, thus making little oval chambers, which were enlarged as the eating went on. They were carefully picked out, and a fresh sod of clover and grass supplied. They had now grown $\frac{5}{8}$ of an inch in length, preserving the same colors.

It is quite possible that a few of the eggs escaped me in the search. I

am of opinion, however, that from fifteen to twenty is the average number laid by one beetle; a number so small, that reckoning the ordinary casualties to which this not very active insect is exposed, it is not likely ever to become very formidable to the agriculturist. In short, the insect lays her eggs in the night,—probably not more than twenty. The hatching of these required, in the present instance, twenty-seven days. It must be remembered that a large portion of this time was remarkably cold and wet. It is almost certain that, with favorable thermal conditions, this might be lessened fully seven days.

These brief notes, added to the article on page 186, may be regarded as giving a degree of completeness to the history of the Goldsmith Beetle, as it is thus pursued from the egg to the imago.—S. Lockwood.

The Seventeen-year Cicada.—Seeing in the July number of the Naturalist a request for twigs of *oak* which had been stung by the so-called Seventeen-year Locust, I take the liberty of sending you twigs from *eleven* different varieties of trees in which the females have deposited their eggs. I do this to show that the insect seems indifferent as to the *kind* of wood made use of as a depository of her eggs. These were gathered July 1st, in about an hour's time, on the south hills of the "Great Chester Valley," Chester county, Pa. No doubt the number of trees and bushes might be much increased. The female, in depositing her eggs, seems to prefer well-matured wood, rejecting the growing branch of this year, and using last year's wood, and frequently that of the year before, as some of the twigs enclosed will show. An orchard which I visited was so badly "stung," that the apple-trees will be seriously injured, and the peach-trees will hardly survive their treatment. Instinct did not seem to caution the animal against using improper depositories, as I found many cherry trees had been used by them, the gum exuding from the wounds, in that case, sealing the egg in beyond escape.

The males have begun to die, and are found in numbers under the trees; the females are yet busy with their peculiar office. The length of wood perforated on each branch varied from one to two and a half feet, averaging probably eighteen inches; these seemed to be the work of one insect on each twig, showing a wonderful fecundity.

The recurrence of three "Locust-years" is well remembered in this locality—'34, '57, '68. There has been no variation from the usual time, establishing the regularity of their periodical appearance.—William Kite, *West Town, Chester County, Pa.*

Museum Pests.—Every naturalist dreads the presence of the entomological rogues whose portraits are here exhibited. The ugly, bristly, insidious larva, which so carefully hides in the body of the dried insect or stuffed specimen it consumes, can be kept out only with the greatest precaution. The most injurious insect is the Larder-beetle, *Dermestes lardarius*. This beetle is nearly half an inch long, oblong-oval in shape, with short legs, and is black, with the base of the elytra covered by a broad gray-buff band. It is timid and slow in its movements, and when dis-

turbed, seeks a shelter or mimics death. Its larva is covered with hairs, the body ending in a pencil of them. The *Attagenus pellio* is a smaller black beetle, with two dots on the wing-covers. Its larva is slenderer and proportionally longer, while the reddish-brown hairs lie closer to the body, so as to make it glisten in the light. We have found the larva of an allied beetle, but nearly twice as large as that of *D. lardarius*, crawling up the side of an out-house.

Anthrenus musæorum (Fig. 1; *a*, larva; *b*, pupa; much enlarged) is a smaller beetle, covered with transverse wavy bands of irregular spots. Its larva is short and thick, with long bristles, which are largest and thickest at the end of the body. The pupa transforms beneath the larva skin during the summer. Two or three other species are found in museums. Among them is *Ptinus fur*, which is figured on page 165 of the present volume of the NATURALIST, of which we here figure the larva (Fig. 2), which was found with the beetles in dead and dried snail-shells, in the Museum of the Peabody Academy. They may be killed like the Clothes-moth, also found in museums, by saturating the specimen attacked by them with benzine. To prevent their attacks, they should be kept out of collections by keeping benzine in constant evaporation in open vessels. Camphor and turpentine and creosote are also very useful. Zoölogical specimens recently prepared should be placed in quarantine, so we may be sure none of the museum pests will be introduced into the drawers or cases of the cabinet while either in the egg or larva state. Their presence in cabinets may be detected by the dust they make falling on the white surface beneath. Specimens thoroughly impregnated with carbolic acid, or arsenic, or corrosive sublimate, will not be attacked by them.

Fig. 1.

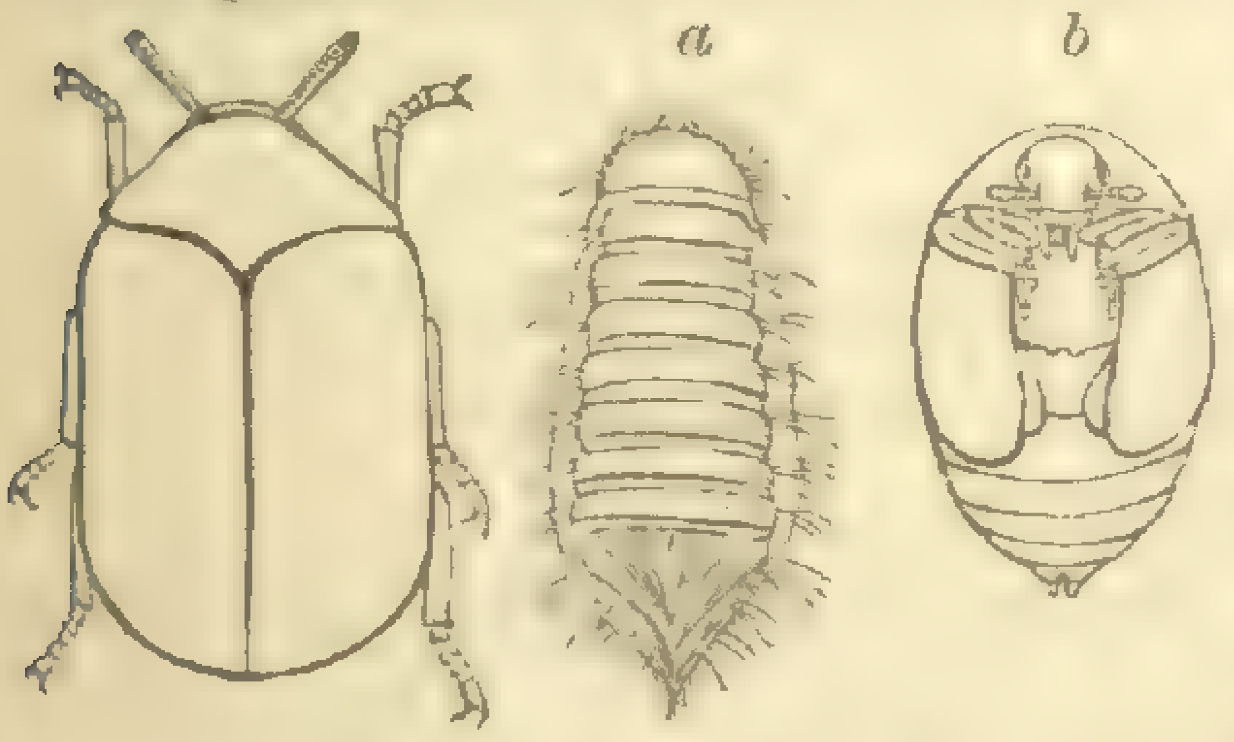
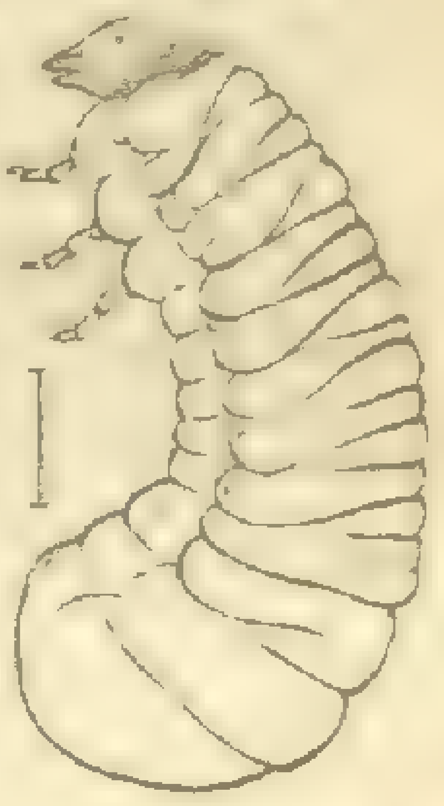


Fig. 2



GEOLOGY.

ANTIQUITY OF MAN.—In regard to the alleged discovery of human bones in the coral formation of Florida (see NATURALIST, Vol. II, p. 386), and which was first published by Professor Agassiz in Nott & Gliddon's "Types of Mankind" (eighth edition, p. 352), and has appeared in other works, including Lyell's "Antiquity of Man," we beg to give our readers the following statement in his own words, by Count L. F. Pourtales, the original discoverer of these bones: "The human jaw and other bones, found in Florida by myself in 1848, were not in a coral formation, but in a fresh-water sandstone on the shore of Lake Monroe, associated with fresh-water shells of species still living in the lake (*Paludina*, *Ampullaria*, *etc.*). No date can be assigned to the formation of that deposit, at least from present observation."

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science.—Natural History Section. *Chicago, Ill., August* 5–12, 1868. In his paper "On the Geology of the Mississippi Delta, and the Rock-salt Deposit of Petite Anse," Professor E. W. Hilgard stated that this deposit was discovered in 1862, and the entire supply during the war, of the western half of the Confederate Government, was derived from this source. The deposit was, at least, thirty-eight feet thick, and extends over a section of one hundred and forty-four acres, and is found in some places above the present sea-level. The salt was remarkably pure and free from gypsum though the latter occurred fifteen miles distant.

In describing the geology of the delta, the author thought its progress seaward was not so much due to a deposit of sediment as to the upheaval of the bottom of the Gulf.

Professor W. P. Blake, of California, read an abstract of a paper "On the Gradual Desiccation of the Surface of the Western portion of North America." He called attention to some of the principal facts, leaving details to a future paper. The principal evidences of a gradual desiccation are found in the interior lake system of the Great Basin in Nevada, where the chain of lakes, between the Sierra Nevada and the Humboldt Mountains, the Truckee, Humboldt, and Carson Lakes, give unequivocal evidence of drying up. Formerly these lakes were united in one, so as to form a vast sheet of water, an inland sea which extended over three degrees of latitude and longitude. This lake has left ancient shores and beaches along the sides of the mountains, the former presence of the water being made known in some places by extensive deposits of tufa which coats the rocks and hides them from view. The Great Salt Lake, also, gives evidence of a gradual wasting away. Its shores are bordered by broad regions of lacustrine deposits. The lakes of the valley of Mexico are also drying up, and there is evidence of change within the historic period. The Tulare lakes in California do not cover near as much surface as formerly, and an extensive region at the head of the California Gulf has dried up. In all the instances mentioned the water-lines and beaches are horizontal, and show that there has not been any local elevation or disturbance. Nor is it probable that any continental elevation has been instrumental in effecting the change. The cause appears to be [illegible]

Professor J. S. Newberry, of New York, presented an abstract of a paper on "The Surface Geology of the Basin of the Great Lakes and the Upper Mississippi Valley." He hoped to give some information which would aid in working out the great problem of the drift. A map was drawn showing the region under discussion. The drift formation has been investigated most generally from the top downwards. This [illegible] of the glacial period in this region has not received sufficient attention

there was an intimate relation between the features described by General Warren and the phenomena now to be noticed. Bowlders are found miles from their native rocks. The valleys of the rivers were excavated by the glaciers to a depth far below their present level. Sometimes shafts are sunk 150 feet before these rock-beds are reached. There was, doubtless, once a river-connection between Lakes Erie and Ontario. Lake Erie was formerly only a river—the ancient river-beds in the vicinity being from 100 to 150 feet below the present level of the streams. At Louisville there was an apparent exception, as there were rock bottoms in the river, but the city occupies the site of the ancient river-bed. Sometimes there are two bluff formations of different ages. All this clearly indicates that formerly the country was more perfectly drained, that is, that the continent was more elevated. When these valleys were excavated the drainage was free to the ocean, similar to the condition in California; and the rivers, by their great erosion, wore away the hard rocks. The origin of the Niagara and Hudson Rivers was evidently glacial. The ancient beds of the rivers on the Pacific Coast were far below their present level, showing great land elevation. It is not certain that the continental elevation was sufficient to afford a temperature essential to the formation of the glaciers, which were afterwards melted and left the material of the drift. The glaciers were not unbroken.

In his paper "On the Geological Age and Equivalents of the Marshall Group," Professor A. Winchell stated that this term was employed as a general designation of the rocks known as "Waverly Group," in Ohio, "Rockford beds," in Indiana, "Kinderhook Group," in Illinois, "Yellow Sandstones," in Iowa, and "Chouteau Limestone" series, in Missouri. It was the object of the paper to prove, first, that these local groups are geologically equivalent; second, that they are the western representatives of the Catskill group, of New York. As accessory considerations it was shown, first, that they are characterized by a carboniferous fauna; second, that this fauna is totally distinct from that of the Portage and Chemung; third, that the Huron group, underlying the Marshall, answers to the Portage and Chemung; fourth, that there are certain conglomerates in Western New York which seem to connect the Western Marshall with the Eastern Catskill group, and thus establish their contemporaneousness. The subject was discussed in two papers: I. Stratigraphical Considerations; II. Palæontological Considerations.

Professor Whitney, State Geologist of California, exhibited the human skull said to have been obtained at the depth of 150 feet below the surface, in Calaveras county, California, and read a long paper on the subject of the fresh-water tertiary, and the later detrital and volcanic formations of that State. He gave a minutely detailed account of the circumstances attending the finding of the skull, as given by Messrs. Mattison & Scribner, of Angel's Camp, and Dr. Thomas Jones, of Murphey's. Professor Whitney stated, that he had visited the locality several times, and had found no reason to doubt the good faith of the parties testifying to the

genuineness of the discovery. The bottom of the shaft, however, he had been unable to examine, owing to the presence of water, which could not be removed without considerable expense. This will be done at a future time, and a full report of the evidence obtained will be laid before the public. A careful survey of the whole region, adjacent to the locality where the skull was found, has been made, and a map, on a large scale, has been made, which is now on its way from California, and which was expected to arrive in time to be exhibited at this meeting, but which has been delayed by some accident. The evidence in regard to the authenticity of the skull was laid before the Association, in order that every one might judge for himself as to its fulness and reliability. An anatomical description of the skull, and the bones found associated with it, by Professor J. Wyman, was incorporated in this paper, from which it appeared that it was very closely related in its character to that of the crania of the present California Indians, and that where it differed from them it approached the Esquimaux type.

Professor Whitney remarked he could not guarantee the authenticity of the discovery, but could only state that the skull had been placed in his hands by gentlemen known to himself as men of veracity, and that his own examinations and those of his assistants, after repeated visits to the parties concerned, and the region in which the discovery was made, had failed to reveal any flaw in the testimony, or any motive for deceit on their part; on the contrary, there were several additional links in the chain of circumstantial evidence which were clearly made out by a comparison of the condition of the skull, as it appeared when it came into his hand, with the statements of Messrs. Matteson & Scribner as to the locality in which it was found.

Professor Whitney insisted most strongly that, apart from anything connected with this skull, the labors of the Survey had clearly demonstrated the fact, that man, and the mastodon, and elephant, had been contemporaneous in California.*

The portion of Professor Whitney's paper relating to the skull, was followed by an abstract of the discoveries of the Geological Survey of California, relating to the animals and plants found in the fresh-water tertiary of that State, and the probable geological age of the different members of this formation, with especial reference to that of the beds of

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*Mr. S. H. Scudder, Custodian of the Boston Society of Natural History, has called our attention to a specimen, interesting in this connection, presented to the Museum of the Society, accompanied by a label of which we made the following copy: "Fossil Human Skull. From a shaft in Table Mountain, California, found 180 feet below the surface, in gold drift, among rolled stones, and near mastodon debris. Overlying strata of great compactness and hardness. Found, July, 1857. From C. F. Winslow, M. D., September 10, 1857."

"Hon. Paul K. Hubbs, State Supt. of Public Instruction, Benicia, California, to Dr. Winslow, August, 1857."

The specimen is a fragment a little over an inch long, and about one-third as broad, and evidently a portion of one of the tabular bones of a skull.—EDS.

which the skull is supposed to have been discovered. Of this portion of his paper, Professor Whitney promises an abstract in time for the next number of the NATURALIST.

THE NATIONAL ACADEMY OF SCIENCE began its August meeting at Northampton, Mass., on the 25th, and remained in session four days; twenty-five members being present. We extract from the daily press a list of the papers read on Natural History.

Professor J. D. Whitney read an account of the "Origin of Bitumens, and of Experiments upon the Formation of Asphaltum;" and papers "On Topography and Topographical Work west of the 103d Meridian;" "On the Discovery of the Human Skull in Calaveras County, California," and "Some Points in the Surface Geology of the Rocky Mountains."

Mr. L. F. Pourtales read a paper on "Deep-sea Dredging in the Gulf Stream," and Mr. W. M. Gabb one on the "Cretaceous and Tertiary Formations in California."

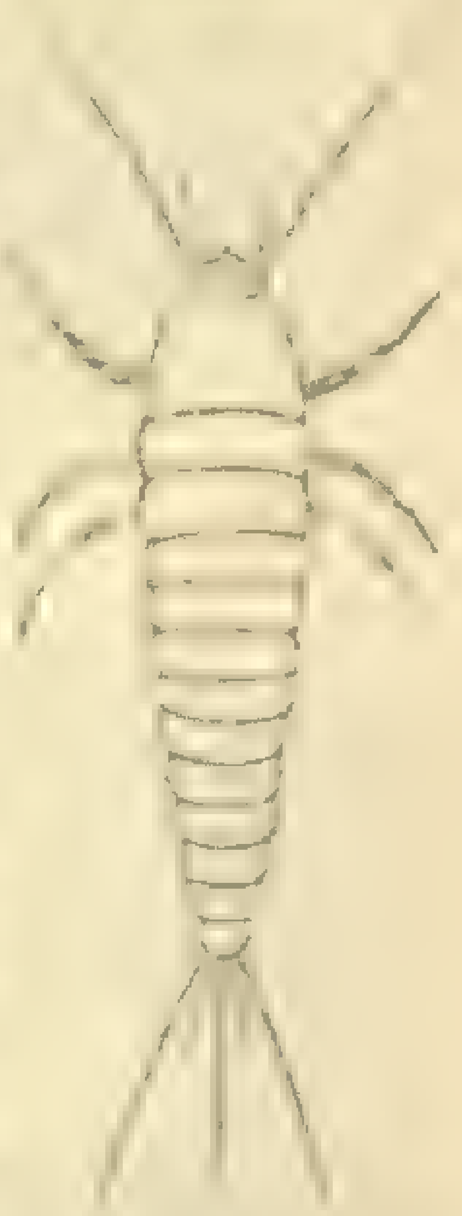
Professor W. H. Brewer made a communication "On the Distribution of Fresh Vegetation west of the Rocky Mountains;" and Professor O. C. Marsh one "On the reputed Discovery of Human Bones at Antelope Station, Pacific Railroad."

Professor G. N. Brush read a paper on "A New Borate from Mine Hill, Sussex County, N. J.;" and Professor J. S. Newberry papers on "The Transportation of the Material of the Carboniferous Conglomerate," and "The Circle of Deposition in Sedimentary Rocks;" and Professor J. P. Lesley read a paper on "Lake Formation."

ANSWERS TO CORRESPONDENTS.

H. H. B., Chicago, Ill.—The small insects you send belong to an unknown species of Podura, or Springtail, which are minute, wingless neuropterous insects with spines at the end of the body, modified into a leaping apparatus. We would be much obliged for specimens in alcohol of these minute insects, of which little or nothing definite is known in this country. We insert a figure of a Springtail, greatly magnified (Fig. 1), belonging to the genus Machilis. The Springtails are found about manure and refuse heaps, in cellars, under stones and sticks in moist places. You write us that the species found by you (which is related to the *Podura nivicola* of Dr. Fitch, which has been found on the snow, and which occurs abundantly under the bark of trees in early spring with us) "made its appearance in large quantities after the heavy rains. They are scattered throughout the lawns in immense quantities, in colonies of from four to twelve inches in diameter. When grouped in such immense quantities, they are of a very dark green color." They use the "spring" almost entirely to leap with.

Fig. 1.



J. G. H., Philadelphia.—Your article was received and promptly acknowledged, but the letter was returned, not having been called for. We shall print the article soon, and illustrate it. Many thanks.

E. L., Brighton, Md.—We will answer your queries about the House-fly in a forthcoming article on the Flies, to be illustrated. Flies do not grow after leaving the pupa state. The myriads of flies, little and big, we see through the summer, belong to different *species*, of which there are several thousand in this country. The Seventeen-year Locust is not known to sting: there is a bare possibility that it may insert its beak into the flesh if held between the fingers, as some other "bugs," or hemipterous insects (such as the bed-bug) are known to do.

G. E. S., Homestead, Mich.—We dare not risk naming the fish from your description. Can you not send the skull? We have ordered the book for you from London.

J. W. S., Cromwell, Conn.—The insect you send is the *Ploiaria brevipennis* of Say, a remarkable hempterous insect, common in the Middle States, but not frequent in New England.

O. N. B., Pomonkey, Md.—We never heard of a Dragon-fly depositing its eggs on its breast. The Libellulidæ are very fully described in Dr. Hagen's Synopsis of the Neuroptera of North America, which can be purchased by applying to B. Westermann & Co., 440 Broadway, New York. We cannot tell what the insect is to which you refer in your postscript without a specimen before us.

W. S., London, Canada.—The insect which you say deposits its eggs in the raspberry stems, is the *Œcanthus niveus*, or tree-cricket.

C. C. C., Lookout Mountain, Tenn.—Any one residing in the Southern States will do us a great favor by sending specimens of "bugs" and insects of all sorts. We want very much insects injurious to the Cotton-plant, especially the caterpillar, chrysalis and moth of the army-worm. Will write you more at length.

W. C. F., Sandwich, Mass.—The insects came safely. The large beetle is probably the *Pasimachus obsoletus* of Le Conte.

S. S. C., Fall River.—The plant is *Marchantia polymorpha* L.

R. A., Fond du Lac, Wis.—The worm you sent was the larva of a fly, *Scenopinus*. We shall have more to say about it in a subsequent number of the NATURALIST. The small "white mites" you found so thick in the flower-pots are, probably, "spring-tails." We know of no jumping-mite.

A. P., Hudson, Ohio.—You may be able to obtain cocoons of the Cynthia Silk-worm from Mr. W. V. Andrews, 264 Third Avenue, New York city.

L. W. B.—Try a solution of two parts of carbolic acid to one hundred of water, and syringe your plants with it. You must proceed carefully so as not to injure the hot-house plants.

S. B., Garrettsville, Ohio.—The shell-like objects you sent are the cases made of grains of sand by the larva of a Caddis-fly. We will give a farther account of them hereafter. Try to obtain the larvæ and flies, as the adult state is not known.

J. B., Haverhill, Mass.—The insects sent belong to a species of *Psocus*, which lives on the bark of trees, often eating lichens; they often occur in great numbers.

F. N. O., New York.—The glass sides of the case, containing the insect you enclosed, broke, and the specimen was unfortunately lost. The best way to send any but the largest insects is to cut or punch a hole through a strip of cork, and then tie on a paste-board cover over the holes. In this way the insect will travel safely, and will cost no additional postage.

J. B., Portsmouth, R. I.—The insects are the male and female of *Strategus Antæus*, a large Lamellicorn beetle.

M. C. R., Hudson, O.—The insects came safely. Please try to raise the worms yourself also.

W. H. L., Clyde, N. Y.—The moth is the *Eudryas grata*.

L. M., Norwich, Conn.—The sample of the so-called Swamp-apple, found on the wild Azalia, was mislaid in some way, and we do not remember seeing it. The caterpillar found on the Common Creeper, *Ampelopsis quinquefolia*, is the larva of *Eudryas grata*. The fact that just before turning to a pupa, it bores into wood buried beneath the surface of the ground, is new and exceedingly interesting to us, as we have long contended that Eudryas is closely related to Castnia, which bores in the stem of plants in the tropics, and is not allied to *Notodonta*, one of the Silk-worm family.

BOOKS RECEIVED.

Land and Water. April 25, May 2, 9, 16, 23, 30, June 6, 13, 20, 27, July 4, 11, 18, 25, August 1. London.

The Quarterly Journal of Science. July. London.

Cosmos. June 13, 20, 27, August 1, 8. Paris.

The Field. June 27; July 4, 18; August 1, 8, 15. London.

American Bee Journal. July, August, September. Washington.

Chemical News. July. New York.

American Cervus. By Hon. John D. Caton. Ottawa, Ill., 1868. 8vo, pp. 43.

The Percheron Horse; translated from the French of Charles du Huys. New York, 1868. Orange Judd & Co. 12mo, pp. 100, illustrated.

The Past and Future of our Planet. By William Denton. Boston, 1868. 8vo.

Journal of Travel and Natural History. Edited by Andrew Murray. Vol. I. Nos. 1–3. London, 1868.

Transactions of the American Entomological Society. Vol. II, No. 1. 8vo, illustrated.

Queries on the Red Sandstone of Vermont. By Rev. J. B. Perry. Boston, 1868. 8vo, pp. 15.

THE

AMERICAN NATURALIST.

Vol. II.—NOVEMBER, 1868.—No. 9.

ON THE FRESH-WATER SHELL-HEAPS OF THE ST. JOHNS RIVER, EAST FLORIDA.

BY JEFFRIES WYMAN, M. D.

[Concluded from page 403.]

II. ARTICLES TAKEN FROM THE SHELL-HEAPS, SHOWING HUMAN AGENCY.

Pottery. In the old world no traces of pottery have been found associated with the earliest flint-implements, and it is therefore concluded that the men who wrought these were ignorant of it. When the European first came to America, some of the tribes were found to be destitute of this art. The Patagonians had no earthen vessels either for cooking or holding water. Instead of such the Esquimaux used wooden bowls, and the natives of the North-west Coast, Oregon and California, water-tight baskets, substituting heated stones for the direct action of fire. But with few exceptions pottery, as an art, was practised by a large majority of the tribes.

If, as daily experience tends to show, man, when first introduced upon the surface of the earth, was at best a pure savage without experience, it follows as a natural consequence that there must have been a longer or shorter time when instruments were unknown to him. We have no adequate grounds for any other belief, than that his knowledge

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and his inventions have been progressively developed, and analogy, as we think, legitimately suggests that the most simple inventions are signs of actual progress, and point back to an earlier state out of which he has emerged. The discovery of the oldest of man's works, either in the form of worked flints, earthen vessels, and of fire-hearths, do not carry us back to his beginning; if we would attain to a knowledge of this, it must be sought for in the remains of his own body, older than all his works.

We have as yet no data for determining the time or the order of his inventions. But of all his works thus far discovered, flint-implements are the most ancient, and earthen vessels the next. The invention of fire and cookery appears to have preceded that of pottery, the proof of the existence of the former being the oldest. The determination of how, and the period when, fire was first made available as an agent, would be one of the most important contributions to the history of the early progress of the human mind.

The shell-heaps on the St. Johns River, like those from the other parts of the United States, show that those who inhabited them were not, strictly speaking, primitive men. They had already made some progress in the useful arts, and however rude their instruments, these were nevertheless inventions, and such, too, as could only have been the result of experience extending through considerable periods of time. They not only used worked stone, bone and shell, but their pottery had passed out of the first and rudest stage into that of comely forms with outward ornament, and, as the table on the opposite page shows, exhibits some little variety in the composition of the materials.

For the purposes of comparison we have included in the enumeration, articles obtained from St. Johns Bluff, where the shell-heap is made up of salt-water species. The table shows that more than three-fourths, eighty per cent., of all the pieces were made of clay without the admixture of any other substance, and that when another substance was added.

it was most commonly palmetto fibre. The use of sand was almost exclusively confined to St. Johns Bluff, where, too, is found the most highly ornamented work, characterized by the most complex figures. The only pieces marked with the impression of a cord were also found at the same place. This kind of ornament was extensively used over the United States, as we have specimens from Illinois and Massachusetts, and has also been observed on the pots from tumuli belonging to the Pre-Roman period of Great Britain.* We have seen no evidence that, as has been frequently asserted, these markings indicate that the pots had been formed in nets. Although the meshes are often regular, there are no signs of knots at the point of crossing of the threads, which there certainly would have been if nets had been used. Traced pottery was confined almost wholly to Old Enterprise, the figures being made with a point, and consisting of combinations of straight lines. These were sometimes combined with indentations. We saw no specimens of pottery made in baskets, though frequently told that such are found. The absence of pounded shells, as one of the ingredients of their pottery, is worthy of notice, especially as shells were in daily use among the natives of the St. Johns.

LOCALITY.	MATERIALS.			SURFACE.				
	Clay.	Clay and Sand.	Clay and Veg. fibre	Plain.	Traced.	Plain Stamped.	Complex Stamped.	Marked with Cord.
Lake Harney, ...	106	0	0	8	2	90	0	0
Burial Mound do., . . .	38	0	2	32	1	7	0	0
Watson's Landing, . . .	62	0	15	67	0	10	0	0
Black Hammock, . . .	210	0	0	142	0	68	0	0
Old Enterprise, . . .	23	2	92	64	50	3	0	0
Old Town, ...	126	0	13	60	1	78	0	0
St. Johns Bluff, . . .	27	28	0	14	1	16	18	12
Total number of pieces.	592	30	122	387	55	272	18	12

The plain-stamped pottery was universally distributed, but was most abundant at Lake Harney and Black Hammock,

*Sir John Lubbock. Prehistoric Times. London, 1865, p. 113.

and is characterized by square, oblong, or lozenge-shaped impressions, regularly arranged, the stamp being of sufficient size to make a large number of them at once, but very often the figures are confused in consequence of the instrument having been applied twice to the same region. In one case the apex of the spine of a Paludina had been used as a stamp. The complex figures on the pieces from St. Johns Bluff, consist of combinations of square, with more or less rounded or curved impressions, giving the whole surface an intricate series of markings, but which we were unable in any specimen found, to reduce to a definite plan. They, however, resemble in their general style the pottery described by Schoolcraft* as coming from the sea-coast, and remind one of Mexican forms.

The size of the vessels, as indicated by the curvature of the fragments, varied from between two and three to twelve inches. The more common kinds appear to have been either shallow like a common pudding-dish, or deep enough to be used as seething-pots, and both are figured in the illustrations to the *Brevis Narratio* of Le Moyne.†

Fig. 1, Pl. 10 (natural size), represents a rude attempt at ornament, consisting of two irregular parallel spiral lines starting from the same point. From Old Enterprise.

Fig. 2, Pl. 10 (natural size), also from Old Enterprise. In this, as was not unfrequently the case at the locality just mentioned, straight lines are combined with indentations made with a round point.

Fig. 3, Pl. 10 (natural size), represents one of the instances of complex figures from St. Johns Bluff. This was made either by one large complicated stamp, or by a series of different stamps, since none of the details are exactly repeated.

Articles of Shell and Bone. The natives of the upper portions of the river were in constant communication with the

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*North American Indians, Vol. III, Pl. XLV.

†De Bry, Hist. Amer. Francforte ad Mœnam. Pars. 2da, pp. 4 and 5.

coast, and, as might be expected, carried marine shells into the interior, some of which were converted into useful articles, especially *Strombus gigas*, *Pyrula carica*, and *P. perversa*, the last acquiring a length of from twelve to fourteen inches.

Fig. 4, Pl. 10 (half natural size), one of the most common instruments, is made of a triangular piece cut from *P. carica*, so as to comprise a portion of the rostrum, serving as a handle, and a portion of the swollen part of the body, which is the useful part of the tool. The sides and apex are smoothed and rounded, while the base is regularly curved and ground to an edge like that of a gouge, but with the bevel on the inside. A specimen presented to me by Dr. H. P. Bowditch, and which he obtained at Old Enterprise, shows quite clearly that it was detached from the shell by first cutting a groove, and then breaking off the fragment. Length from 80 to 90 m. m., breadth from 60 to 70 m. m.

Fig. 5, Pl. 10 (half natural size), represents a species of Pyrula, with thick and heavy walls; the lip and nearly the whole of the rostrum are ground off, and a somewhat irregular oval hole with rounded edges is made between the first and second row of tubercles, and quite near to the mouth. Though such an instrument would give resonance to the voice, the position of the hole is not such as to adapt it most favorably to be used as a horn. It may, nevertheless, be the instrument which Bartram states was still in use when he visited the St. Johns, and with which, he says, "on one and the same day, early in the morning, the whole town is summoned by the sound of a conch-shell, from the mouth of the overseer, to meet in the public square," for the purpose of entering upon the work of cultivating the soil.*

Fig. 6, Pl. 10 (natural size), is a portion of the rostrum of Pyrula, 60 m. m. in length, the two ends of which have been obliquely ground.

Fig. 7 (natural size), a piece of bone with a central cavity,

* Travels in Florida. Philadelphia, 1791, p. 512.

into which a hole has been drilled at each end. This was found at Horse Landing, midway between the top and base of the shell-heap, and was the only object found actually within the shell-heap, which was clearly the work of the human hand. Nearly similar forms are figured in the plates of the *Brevis Narratio*, as forming a part of the necklace worn by the natives.*

Fig. 7.

Fig. 8, front view; fig. 9, side view (natural size), represents an instrument made of shell, which, from the exterior markings seen in some, and the thick ridge on the inside in nearly all,

Fig 8.

Fig. 9.

appears to have been cut from the borders of the mouth of *Strombus gigas*. Several of these were found, but all more or less broken. When whole the length was about 150 m. m., breadth from 50 to 60, and the thickness 25 to 30 m. m. The broad end is ground to a blunt edge like that seen in most of the stone chisels from the other States, and the other as ground to a blunt point. The instrument closely resembles the shell-adze used by the Kingsmill islanders, specimens of which, with their handles attached, can be seen in the Smithsonian collections. One of the specimens has been twice perforated by a Lithodomus, and thus so far weakened as to lead to fracture. These perforations were undoubtedly made before the instrument was wrought. Its outer surface is largely bored by worms.

A large specimen of *Pyrula perversa*, from which the interior whorls had been broken out, was found at Blue Spring. Such as this were used as drinking horns, and

* Plates XXXVI, XXXVIII, XXXIX.

are mentioned by Le Moyne, though his figures, drawn from memory, as might be expected, do not agree with this or any other species.

Besides the implements of bone already mentioned, a portion of the radius of a bear, which had been divided by cutting a groove around the outside and breaking the rest, was found at Old Town; and Mr. Bowditch gave me the antler of a deer which had been similarly treated, and which he found at Enterprise.

Articles of Stone. The collection of stone implements was quite small, only twenty-five or thirty pieces, nearly all of which were picked up on the shores near Old Enterprise, only a few being actually dug from the mounds. A single chisel of the ordinary form, and with a remarkably sharp edge, was found at Old Town, but all the other articles were either arrow or spear-points, and none of them had unusual shapes. No pipes or fragments of them were found at any place.

Fig. 10, Pl. 10 (half natural size), represents the rude attempt at an arrow-head, mentioned on p. 403, and found by Mr. Peabody under the lowest portion of the shell-heap at Horse Landing.

We will add to the above two pieces of worked shell, both of which were, however, taken from the burial-mound at Black Hammock, near the shell-heap, but were undoubtedly in common use among the natives.

Fig. 11, Pl. 10 (natural size), is an ornament cut from that portion of a Pyrula, namely, the suture, where one whorl joins the preceding, and is bent to nearly a right angle; the length of the upright portion is 45 m. m., and the disk at the bottom measures 31 by 24 m. m.

Fig. 12, Pl. 10 (natural size), a disk of shell, 18 m. m. in diameter, and 5 m. m. thick, with a hole drilled through the centre. A similar one is figured by Schoolcraft.*

Remains of Animals. The subjoined table gives a com-

*Notes on the Iroquois. Albany, 1847, p. 243.

plete list of the different kinds of animals, indicated by the bones found in the different mounds. The species most commonly met with are the Deer (*Cervus Virginianus*), the Terrapin (*Emys Floridana*), Soft-shelled Turtle (*Trionyx ferox*) and the Alligator (*Alligator Mississippiensis*). The condition of the bones in many instances, particularly those from Old Enterprise and Horse Landing, indicated that they had been long buried, inasmuch as they had lost nearly all their organic matter, and when exposed to heat scarcely changed their color. In many instances they were incrusted with a deposit of lime, and had the shells in which they were embedded cemented to them. The bones of birds are quite rare, even those of the wild turkey and of the various species of ducks, which in the winter frequent the rivers and lakes in immense numbers. Of fishes, the species most commonly represented are the gar-pikes (*Lepidosteus*), and a cat-fish (*Pimelodus*).

In the illustrations to the *Brevis Narratio* of Le Moyne, Pl. XXIV represents a fire over which is built a frame, and on this, exposed to heat and smoke, are several animals, among which can be recognized the deer, a small mammal, the mouth of which resembles that of the opossum, an alligator, an eel or a snake, and several species of fish. Several Indians are standing near, one fanning the fire, and another holds an alligator under his arm. On Pl. XXIII. natives are represented carrying food in baskets, one of which contains a deer, a fish, and an alligator. This is quite too large a load for one basket, and too much importance must not be attached to these plates, since they were drawn from memory, but they may be taken as an indication of what the kinds of food were. In the text, the writer states that they "ate freely of the flesh of the alligator, which is white and clean, and which we should have eaten often had it not been too redolent of musk."* This objection we have found from personal experience to be a valid one.

* Ibid., p. 5.

SPECIES OF ANIMALS FOUND IN THE SHELL-MOUNDS.	Lake Harney.	Watson's Landing.	Black Hammock.	Enterprise	Blue Spring.	M'd above Osceola.	Oldtown.	Horse Landing.
Deer, *Cervus Virginianus*, ...	*	*	*	*	*	*	*	*
Bear, *Ursus*, ...							*	
Raccoon, *Procyon lotor*, ...				*	*		*	
Opossum, *Didelphys*, ...		*		*				
Turkey, *Meleagris gallopavo*, . . .						*	*	
Birds, not known, ...	*	*					*	*
Terrapin, *Emys Floridana*, . . .	*	*	*	*	*	*	*	*
Soft-shelled Turtle, *Trionyx ferox*, .	*	*	*	*		*		*
Species of Turtle not known, . . .	*					*		
Alligator, *Alligator Mississippiensis*, .	*	*	*	*		*	*	*
Catfish, *Pimelodus*, ...	*					*		
Gar-pike, *Lepidosteus*, ...	*			*		*	*	*
Fish, not known, ...	*			*				

That the animals of the shells which form the materials of the mounds were used as food, there seems to be no reasonable doubt. Unios are known to be edible, and, almost exclusively, form the shell-heaps on the borders of other rivers as the Ohio,* the Tennessee,† the Concord, etc.‡ We are not aware of any evidence that Ampullarias and Paludinas have been so used elsewhere than in Florida, but their association with pottery, and charcoal, and the bones of edible animals, seems to be decisive. If the inference we have drawn be correct, then it follows that the animal food of the ancient inhabitants of Eastern Florida was very largely derived from these species, and especially the Paludinas, since the remains of fish, turtles, alligators, and deer, form so insignificant a portion of the whole heap.

In view of the vast number and size of the shell-heaps now known to be scattered along the Atlantic coast,§ and the vast quantities of shells which compose them, it is quite clear that the aborigines must have depended largely upon shell-fish for food. In fact such was obviously the case with the early inhabitants of the old world as well as new. Of the

*Atwater, Archæologia Americana, Vol. I, p. 226.
†Brinton, Smithsonian Publications, 1866, p. 356.
‡J. Wyman, Proceedings of Boston Society of Natural History, Vol. XI. p. 243.
§Dr. Joseph Leidy, Proceedings of Academy of Natural Sciences, 1866, has described the shell-heaps at Cape Henlopen, and should have been cited in our communication in the NATURALIST for December, 1867, but at that time we had not seen it.

extent to which vegetable substances were made use of, the shell-heaps offer no evidence; but it seems certain, that until the bow and arrow, the trap or the net were invented, the animal food must have of necessity been derived from such species as could most easily be obtained, and among these the shell-fish and the more sluggish reptiles would first attract attention.

III. AGE.

No satisfactory data were found for determining the age of the shell-heaps. The appearance of great age which some of them have, as at Horse Landing and Old Enterprise, is important; the same may be said of the fact that the bones embedded in them had lost nearly all their organic matter, and at both of these places were incrusted with calcareous deposits, in some instances forming a conglomerate. The time required for these last results is not necessarily very great, but the organic matter of bone is destroyed very slowly, and is largely present in those of some of the extinct animals. We have obtained a larger quantity of animal matter from the bones of the Mastodon than from those of the deer at Old Enterprise.

The most trustworthy records are found in the forest trees growing upon the mounds. These give us a minimum age with some approach to accuracy. The live-oaks (*Quercus virens*) are not only long-lived, attaining an age of many centuries, but their wood is the most durable of all the forest trees of the United States. One of these, which had fallen from the effects of age, lies upon the top of a mound in the woods near Blue Spring, and measures five feet and six inches in diameter. As it was on the summit of the mound, it could not have begun to grow until the mound was nearly or quite finished; it *may* have begun many years later. It had been dead for a long time; its bark, all of the small and most of the large branches had disappeared. These trees after they are dead still remain erect for many years. Some

of them girdled more than thirty years since, can still be seen standing firmly in the Indian-old-fields. It certainly would not be extravagant to say that the tree in question had been dead more than half a century. Fragments of pottery were found in the earth and shells contained in the upturned roots of this tree, and on sinking a pit in the place formerly covered by the upright trunk, others were found at a depth of from two to three feet. We had neither the tools nor the aid for making a section of this trunk to count the number of annual rings. Through the kindness of Commodore John Rogers, of the United States Navy, we have received a section from a tree nearly a century and a quarter old, and find that at the beginning of the second century there are about fifteen rings to the inch. In later periods of the life of the tree they would of course be more numerous. Assuming fifteen to the inch as the average, a half diameter of thirty-three inches would give 495 rings, or nearly five hundred years; if to this we add fifty years for the time since the tree died, there can be no doubt that the mound was substantially as complete as now more than a century before the discovery of the country.

We know of no data based on the quantity of materials of which the mounds were formed, on which to estimate the time required to build them; to this end, it would be necessary to know the number of persons occupying the place, and the daily or annual consumption of food. If, as is the case of mounds built up in the swamps, they were resorted to only by those who could find camping conveniences upon them, the number must necessarily have been very small.

The later aborigines had no traditions with regard to these shell-heaps, or the burial-mounds which are sometimes near them. They ascribed them to a former race. Florida, however, has been more than once overrun by exterior tribes, and the absence of traditions might in this way be accounted for, since these would be likely to be lost with the change of inhabitants. Under the most favorable circumstances tradi-

tions form an uncertain basis for history. If, therefore, on the one hand there is no proof of great antiquity, it may still be claimed that there is nothing inconsistent with it, and that the appearances of the mounds, and facts connected with them, largely favor it.

IV. ST. JOHNS BLUFF.

It was the special object of this paper to describe only fresh-water shell-heaps, but as we have visited two deposits consisting of marine species, chiefly oysters, we will add a few words with regard to them, especially the above-mentioned locality. The one at Fernandina, on the northerly end of Amelia Island, has already been described by Dr. Brinton,* who has given the most satisfactory proof of its human origin, and of other similar deposits on the Atlantic and Gulf coasts of Florida. The result of our own observations at Fernandina are confirmatory of what Dr. Brinton has recorded, and afford some additional evidence from the earthworks thrown up during the rebellion, and the mounds over the soldiers' graves in the rear of Old Fernandina, in making both of which, portions of the shell-heaps were uncovered, and the contents, similar to those previously noticed, exposed.

St. Johns Bluff has a twofold interest, for it was not only a favorite resort for the Indians, but was the scene of two of the most tragic events in the early history of the continent.† It is situated on the right bank of the river, and about five miles from the mouth. Like all the adjoining shores, it is composed of a fine yellowish silicious sand. It is about forty feet high on the front, and at the eastern end rises quite

* Floridian Peninsula, p. 177.

† It was here that the French, under Jean Ribault, in 1564, built Fort Caroline with a view to establish a Huguenot colony, which in less than eighteen months Menendez, with the purpose of impeding the progress of Protestantism captured, put the garrison to the sword, and set up the inscription, "not as to Frenchmen, but as to Lutherans." Two years later Dominique de Gourgues avenged the atrocity, by retaking the fort, killing the captives, leaving behind attached to a tree another inscription, "not as to Spaniards or mariners, but as to traitors, robbers, and murderers." See Parkman, Pioneers of France in the New World. Boston, 1865, p. 157.

abruptly out of a marsh, and to the westward, *i. e.* up the river, descends at first by a rapid, then a gentle slope, which merges into a nearly level plain, backed by the thickly-wooded hills; beyond this is a marsh, which, still farther to the westward, is bordered by a creek.* The base of the bluff is washed by a swift current at every tide, so that it is constantly undermined, and is rapidly disappearing. Earth-works thrown up on top during the rebellion have already begun to fall. I was told by a man living near by that an oleander tree, which I saw lying at the water's edge to the westward of the bluff, a few years since was thirty feet from the shore in the middle of a garden.

At present the bluff itself must greatly differ from what it was when the French came, and it is highly probable that more of it has been destroyed than remains. The site of Fort Caroline has not been identified, and has probably disappeared. The bluff presents a front of clear sand, is overgrown with trees except where military works were thrown up, and beneath the vegetable mould, a few inches thick, is a layer of oyster shells, with a very slight admixture of sand, extending from two to three hundred feet along the more easterly portion, and varying in thickness from a few inches to three feet. A second and much thinner layer is seen to the westward, where the land rises only eight or ten feet above the water. It is not improbable that the two deposits were originally connected, the intervening portion having been washed away. Fragments of pottery which have fallen from the banks are scattered along the whole shore in front of these deposits, and on examining fresh sections made by the falling of the bluff, and also in making excavations in undisturbed portions, similar fragments were found in place, and so there can be no doubt that the shells and pottery were simultaneously deposited. After careful search no flint or other implements were found during my visit, either

*Mr. Parkman's description of St. Johns Bluff, in the work already cited, is admirable for its portrayal of the general landscape as well as the individual details.

in the bluff itself or along the shore, neither were the bones of edible animals found mingled with the shells. Flint implements have, however, been obtained in considerable numbers, and an arrow-head was given me by a negro, who had picked it up near by. The various excavations for military purposes, revealed the existence of shells several hundred feet to the rear of the present front of the bluff, and beyond the creek to the westward of the marsh is a farm, where pottery and shells may be seen loosely scattered over a tract of many acres in extent, wherever the plough has turned up the soil.

The shell-mounds of the sea-coast, as well as of the interior, seem to have passed almost unnoticed by the early writers on Florida. Dr. Brinton quotes a single passage, the only one met with by him relating to the subject, from Cabeza de Vaca, in which it is stated that the houses of the Indians were "built of mats on heaps of oyster shells."*

ENUMERATION OF THE SHELL-HEAPS VISITED.

Besides those mentioned in the following list, there are many others not visited by the writer, some of which are said to be of even longer dimensions than any seen by him.

The localities are mentioned in the order in which they stand on the river, beginning with those nearest the sources.

1. Rattlesnake Hammock, on Salt Creek, right bank, and near the union of the creek and the St. Johns.
2. Solee's Landing, right shore of Lake Harney.
3. King Phillip's-town, left bank of the St. Johns, a mile below the outlet of Lake Harney. There is a large burial-mound near this locality.
4. Another shell-heap, one mile below preceding.
5. Watson's Landing, right bank between Lakes Harney and Jessup.
6. A mound one mile above preceding, on the same side of the river.
7. Black Hammock, left bank, just above the outlet of Lake Jessup. There is a small burial-mound here.

8 & 9. Two mounds on the right bank and below the preceding, but separated from the river by a large lagoon.

10. Spear's Landing, about five miles above Lake Munroe, left bank. There is a burial-mound at this place.
11. Buzzard's Roost, left bank, near entrance to Lake Munroe.
12. Doctor's Island, right shore of Lake Munroe, above Enterprise.

*Floridian Peninsula, p. 179.

13. Old Enterprise, right shore of Lake Munroe.

14. Outlet of Lake Munroe, right bank.

15. Wekiva, right bank.

16. Blue Spring, right bank.

17 & 18. Two mounds in the woods below Blue Spring, with a wide swamp between them and the river. A third but small mound was found about a half mile from them.

19. Mound above Hawkinsville, left bank formerly, and still ought to be called Osceola, or, as Dr. Brinton writes the name, Ass-se-he-ho-la, Rising Sun, after the celebrated chief who was prominent in the Florida War.

20. Mound below preceding, left bank, having the usual appearance of the other shell-heaps, but in which we failed to find signs of its artificial origin.

21. Old Town, left bank, seven miles below Hawkinsville.

22. Small mound in the woods in the rear of the preceding.

23. Mound above the outlet of Lake Dexter, left bank.

24. Mound below the outlet of Lake Dexter, right bank.

25. Fort Butler, left bank.

26. Volusia, right bank.

27. Rope's Island, right bank, entrance of Lake George.

28. Drayton's Island, now Rembrandt's Island, at the outlet of Lake George, left bank.

29. Horse Landing, right bank, eight miles above Palatka.

30. Palatka, left bank, one hundred miles from the mouth of the river.

31. St. John's Bluff, right bank, five miles from the mouth of the river.

32. Old and New Fernandina, at the northern end of Amelia Island.

THE POTATO-MOULD.

BY JOHN L. RUSSELL.

Mould and mouldiness are two words with which every one is familiar, but few are aware how numerous and diversified are the forms under which the little plants these words designate occur, and to what extent is the mischief they occasion, or know much of the utility in the plan of nature they sustain.

The science of botany as such does not date back very far, and in its place and prior to its existence, all vegetable growth was regarded with a superstitious, and in most cases

with an useless reverence, containing as was supposed some rare power in healing, or some efficacy in incantations and magic.

With regard to the moulds, it was Micheli, who in 1729 published his Nova Plantarum Genera, that established the scientific character of the genus Botrytis, on which since, from certain structural differences in the mode of producing the seed, other genera or distinct kinds of mould have been constructed. Of these, Corda instituted the genus Peronospora; the minute moulds which belong to it, and they are numerous, infesting only living plants. The discovery that their presence caused injurious effects and even great loss is of modern date, and to the investigations of Professor Caspary of Bonn, the botanist and the agriculturist alike are indebted for the valuable knowledge.

The words "mould and mouldiness," familiar as they are, are now significant of topics interesting to the farmer, and by them he is annually subjected to the loss of his cabbages, clover, lettuce, onions, parsnips, peas, potatoes, etc.

To the common eye, and unaided by science, mildews, mouldiness, and similar microscopic plants, would be readily confounded. But the mildew is a much more highly developed fungus, and though apparently as dangerous, is not so to the same extent. The egg-like mould (*Oidium*) which covers and suffocates the young gooseberry or the grape, readily yields to agents which will destroy it, and set free from its threads the swelling fruit; but the potato-mould for instance, is the inception of the potato-rot, which is so dreaded.

The "moulds," then, are fearful parasitic plants, which riot on the tender tissues of other plants, and eventually cause their death. It is estimated that in Europe no less than ten different kinds of fungi are known as infesting the potato, and probably the number in this country is no less. It is on this account that those who have attempted to describe the potato disease among us, have differed so widely from

each other; and while each has thought the other wrong, all have attained some approximation to the truth.

The potato-mould is the *Peronospora infestans* Caspary, and were it not for its effects, would be regarded by every one of taste as a beautiful object. Were we flies or insects, which are so liberally endowed with sight and eyes, and quite unconcerned about the crops, the leaves of the potatoes would be quite a pretty set of objects to investigate, presenting handsome, white, many-branched and beaded-twigged plants, with oval or egg-shaped seed-bodies on the tips of each smaller branch. These vegetable growths issue from the breathing pores of the leaves, and besides feeding themselves on the nutriment intended for the leaves, choke up the internal and external passages and prevent the healthy action from being maintained. Soon the leaves become at first paler, or yellow, then discolored spots appear, then the stems are spotted with dark patches. Even the cellular tissue (or pulpy part of the stems or stalks, "potato-stalks" as we call them) is discolored and filled with dark clotted substances: subsequently, sooner or later, the stalks putrify, the skin separates from the harder or woody portions; next the tubers suffer, spots and decay appear in a more or less regular manner of concentric lines, the skin withers, a white mouldiness often occurs, especially if the potatoes lie in a moist place; the "rot" increases with fearful rapidity, the tuber has a disgusting odor, certain smaller insects help the process at this stage, and putrescence closes the scene.

A plant thus simple in its general structure, and capable of bearing on its rapidly growing branches three thousand two hundred and seventy (3,270) seed-like pods, each containing at least six seed-like bodies (*zoöspores*) on one square line of the under surface of the leaves, and from each of which in turn a perfect seed-bearing "mould" is produced in eighteen hours, may be readily conceived to be capable, minute as it is, of incalculable mischief. The reader may, however, calculate by reduction to fractions of an inch, the

size of one of the seed-vessels (*acrospore*) containing these six or more seeds, when Professor Caspary computes its breadth at $\frac{1}{165}$ of a millimetre, and its length at $\frac{1}{125}$ of a millimetre (*Monatsberichte der Königl. Akademie*, etc., *für Mai*, 1855). Seeds, so minute, can be readily absorbed by the roots or even by the leaves, and in such abundance that the very atmosphere may be surcharged with them. A few of them placed in a drop of water and applied to the leaves, stems and tubers, by Dr. DeBary, produced in a short time brown spots, and eventually the disease.

The remedy or the prevention, what? Perhaps none as yet discovered which will be effectual, but the entire destruction by fire of all infected stalks and potatoes looks to a suggestive prevention.

DEER AND DEER-HUNTING IN TEXAS.

BY CHARLES WRIGHT.

In the States east of the Mississippi river, the number of persons who have seen deer in the wild state is comparatively small, and they are exceedingly few who, by personal experience, have learned much of their ways. And, as these animals are fast disappearing, so also are they who have had the opportunity of studying their habits in their native haunts. Hence, it seems not inappropriate to put on record such information as I have gained, partly from personal experience, and partly from others who have had far more and better opportunities of knowing them well.

The deer is by nature a timid animal, and persecution makes it more so. Even the gentlest pet that will take food from the hand or lick the fingers will not suffer that hand upon the back without shrinking. Of the very different degrees of domesticity to which animals attain, that of the deer is among the lowest. According to the frequency and

the manner in which he is hunted, so is his cautiousness increased. If he is chased, the voice of the dog, though at a distance, rouses him from repose to seek safety in flight. When hunted by men on foot, as in the Indian country, he becomes wary of footmen, but will allow a rider to approach him quite closely. Just the reverse takes place when the ordinary mode of hunting is on horseback. It is also a prevalent belief that, where Indians are the principal hunters, he learns the difference, and becomes comparatively fearless of a white man. This is akin to the notion that the crow can distinguish a man with a gun from one who has only a stick, though it may resemble a gun.

The old bucks consort together most of the year; the does and young bucks go in herds by themselves. When the does have their fawns in the spring, they separate from the young males, and from each other, and remain for some months with no companion but the fawn, until it is pretty well grown. If a fawn, quite young, be met by a man on horseback, it will follow the horse as if it were its mother. One caught within the first few days after its birth becomes quite tame in an hour or two, and makes no effort, afterwards, to escape. Yet, it never becomes domesticated like the dog or cat; and, though it will stay in and around the house, and among the cattle, dogs and people, it runs away to the woods within two or three years.

Deer are very silent animals. Only two sounds that can perhaps be called vocal have been heard by me. One is a cry of terror or of pain. The fawn, when caught, bleats like a lamb or kid in like circumstances, and the grown deer, when the backbone is hit by the bullet, falls in its tracks and often emits a similar cry of pain, or it may be of terror, for it is sometimes repeated when he is seized by the hunter, or even when the latter is seen approaching.

Another sound is a kind of snort,—a forcible emission of air from the nostrils. The hunter says he "blows;" it may be a note of anger or defiance. At the season when the doe

is rearing her young, if she is surprised near the fawn, and yet if the danger be not very imminent, she will stand and "blow," occasionally raising a forefoot and stamping with it on the ground. The bucks also blow, but less frequently.

If my memory does not deceive me I think I have heard the hunters speak of other sounds made by deer,—a faint call of the mother to the fawn, and the reciprocal cry of the young. There may be also a sexual call. I think I have heard such an one spoken of, as uttered at the time when the males seek the females.

The hair is shed twice in the year. The summer-coat is red; not exactly the color of a red cow nor that of a bay horse, yet not very unlike either. The fawn is similar in color, with two rows of white spots, and scattering ones on each side, which it retains often long after the winter-coat is assumed. This is called the blue. It is rather an ashy-gray, or near a slate-color. The hairs are longer, much closer, whitish, except the tips which are dark, or ringed with white and dark spaces.

It is a current belief that deer feed principally on grass. This is far from being correct. They love what is tender and juicy. They resort always to a recent burn, when grass and weeds are just shooting again and are soft; then abandon it for a newer one, so soon as the plants have become hard or tough. If the track of deer be followed, the grass will never be found cropped by the mouthful, as it is eaten by horses, cows, and sheep. Deer select here only a blade or two, there a tender twig or leaf; but they are fond of fruits of almost every kind. In early spring they visit the ponds in which the May-haw grows, the fruit of which is juicy with the flavor of the apple, though too, sour. Later they resort to huckleberry bushes, grape-vines, and persimmon trees, and finally to the oaks. All kinds of acorns, but especially those of the annual trees or sweet acorns, are greedily eaten by them; also chinquapins: and where chestnuts and deer are found together, doubtless the former yield food to the latter.

They sometimes trespass on cornfields, where they crop the bean-vines if there are any, but I am not aware that they injure the corn.

The bucks shed their horns late in the winter. I have heard it affirmed that they pull them off with their feet, when the time arrives that they should be shed. It is quite probable, too, that they may be pulled off when running through thickets. They are sometimes observed at this season with but one antler. It is reasonable to suppose, also, that they may be thrown off by a violent shake of the head when nearly ready to fall, particularly where there are no bushes, as in the great prairies. They soon begin to grow anew, increasing rapidly, and at first they are flexible and covered with soft hair. In this stage they are said to be "in the velvet." In August they have become fully formed; and at, or before this time, they rub their horns against bushes to rid them of the velvet. I have often seen bushes stripped of their bark at a later season, and I conjecture that the practice is connected with the sexual passion. Another custom I am quite confident is due to this cause. They stand under the spreading branch of a tree, which may be about at the height of the animal's head, and paw away with the feet all the leaves and weeds, or herbs if there be any, making a bare spot of ground two or three feet in diameter. This is done only at the period when the buck runs the doe. It is said that bucks will run a castrated individual of their own sex as they do the doe. The place is visited either by different animals from time to time, or some one deer returns repeatedly to the same spot to scrape anew. Whether it is done by one or both sexes I do not know. It is, probably, analogous to the habit of the bear when he barks a pine tree. The second year the antler of the buck is a simple spike; and, according to the general belief, a branch is added each year for five or six years, after which there is rarely any increase in the number of points. I killed a buck with one antler normally formed,

the other smaller, in an atrophied state, and so soft as to be easily broken.

What becomes of deer's horns? A few years ago I saw an attempt to answer the question by some person in one of the Southern Atlantic States, and he arrived at the conclusion that the animal covers them or they would be oftener found. But, in the first place, deer are not so plentiful there that they must be expected to scatter their horns very thickly over the open parts of the forest where they would be readily seen. And, again, each large buck has but two horns thus to dispose of each year; and the large bucks are not very numerous, while the antlers of the small ones are inconspicuous. But the writer had, or thought he had, evidence that the buck covers his antlers with leaves. Doubtless they are so covered by leaves which fall upon them, according to natural laws; but in the forests, and particularly in the prairies of the west, I have seen hundreds which certainly had never been covered by the animals that dropped them. They decay in the ordinary course of nature, and are also eaten by some small rodent, whose tooth-marks I have often seen upon them.

It may not be known to many that bucks often "lock horns," and it sometimes becomes a "dead-lock," literally. I have met, during my hunts, more than one pair of heads thus coupled together, and I killed one pair of bucks so firmly united, that they would have died of hunger if I had not put them to death in a manner less lingering and painful. These animals had evidently come together with great violence; the antlers had yielded to the shock, and had closed again in such a manner that no ordinary exertion of strength was sufficient to separate them. It is not very easy to explain their position: but the beam of the left antler of one was behind, and in close contact with the bases of the two antlers of the other, while the tips of the right antler of the former were locked in the tips of those of the latter. When, later, the skin on the back of the head at the base of the

antlers dried and shrunk, room was made for a little movement, and they could then be unlocked.

At the close of summer the does have become lean,—the effect of rearing the fawn,—while the bucks are in prime condition. Then begins the running season, when the bucks grow careless, or fearless, or both, and fall an easy prey to the hunter. The does, too, seem less wary, or are more intent on feeding. They improve rapidly in condition, especially if mast is plentiful, becoming before midwinter fully fat. The bucks, in their turn, become lean and big-necked, and the flesh acquires a rank taste, so as to be quite unfit for food except under the influence of extreme hunger.

The deer's three senses,—sight, hearing and smell,—are neither of them, by itself, quite adequate to advise him of danger. A noise excites his attention and calls in vision to discover the cause, yet both together may not insure his safety, if danger be near. The noise may be made by the leaping of a squirrel or the scratching of a bird among the leaves; or, it may be any other of the thousand notes that a listener can hear in the *silent* woods. If alarmed by any of these, he recovers confidence when apprized of the cause.

The sense of vision seems to be imperfect in this particular; it takes no cognizance of form and little of color, unless the form and color be those which come most naturally within the sphere of its recognition,—those of its own species. It is motion that draws its attention. When sitting quite still a deer has approached within a few feet of me, and walked quietly away again, unaware, although I was in plain view all the time, that it was so close to one who might have been its enemy. But when a deer *smells* danger, it needs not to look nor to listen. Hence, the attempt to approach him is useless when the wind is blowing from the hunter towards him. But this sense is the least valuable when he is to windward. Acting, then, on his knowledge of these faculties of the animal to discern danger, and their limitation, the hunter, by advancing *against* the wind, or at

least, *not with it*, has nothing to fear from this sense, and has only to deceive the other two. He learns to walk in almost perfect silence, and if he can avoid being seen, his point is gained. Upon a single deer the approach is comparatively easy. He is generally walking slowly, and now and then putting down his head to crop something. In this latter case he cannot see an approaching object; but the moment he raises his head to look about (which he does as often as every half minute or thereabouts), the hunter stops and remains quite still. The deer, at every movement it makes, putting down or raising its head, shakes its tail. Knowing this, the hunter knows just when to advance and when to stop. Thus observant of every motion of the animal, he makes an approach, of which it is quite unaware; and, should it at length perceive the final movement,—the preparation to fire,—it does not immediately run away, but waits a little to see what is the matter. When two deer are together, it is more difficult to come near them, as they may not both feed at the same moments, unless by accident; and the difficulty is increased just in proportion as the number of the herd is greater; and when there are several together, it is nearly useless to attempt to come within gunshot, but better to go away and look for a smaller herd. This is the mode of hunting where, as in prairies, there is no means of concealment. In woods the hunter advances under cover of trees or bushes.

The best hour for hunting is the first clear daylight of the morning. Just before night again, deer are generally feeding. In the summer time they will get up at any hour of the day if a shower comes on. When flies or mosquitoes are very numerous they keep within the thickets by day, and feed almost entirely by night. At such times, fire-hunting may take the place of still-hunting. It is generally known that when dogs, cattle, horses, and many other animals look at a bright light by night, the rays are reflected; and, to any one in the line passing from their eyes through

the light, they look like balls of fire. Deer will, oftentimes, suffer the hunter, with a light, to come very near them. An old frying-pan, having its flat bottom replaced by some curved iron hoop, serves to hold the pieces of resinous pine. The handle is fastened to a strip of plank which is borne on the shoulder. The deer gazes at the light and sees nothing of the hunter who is between it and the fire. Generally, deer can be approached more closely by night than by day. The aim is at the eyes, or straight below them so as to break the neck; or the body is often seen, so that the hunter can shoot where he pleases. A deer rarely falls, when shot, where it was standing, but generally dashes away fifty to a hundred paces or more, even if shot through the heart. If he raises his tail,—shows the white feather,—it may be suspected he was not hit. If struck by the bullet, he runs off at his utmost speed with the tail pressed close down. In the day-time, the hunter goes where the deer was standing, which may be known by the deep tracks made at the first spring, and looks for hair cut off by the bullet. If he finds it, he is sure of having hit his game; and following on the track, he soon comes upon the blood, when he can track it more easily. This is where there are bushes or tall grass. In more open places, the deer may be seen to run its race and fall dead. If any part of the spinal column be touched, the animal falls where it is standing, but if the bone be only slightly hurt it may get up again. I have had a case or two of this kind, when, just as I was about to bag my game, he has jumped up and taken leg-bail.

This account of the deer will hardly be complete without some remarks on the chase, and of this I know nothing by personal experience; but there is no lack of narratives and incidents relating to this gentlemanly and royal sport. So I will only touch upon one peculiarity of the chase in Texas, as I heard it from those who had followed it in the states from which they came. It was said, that in the Atlantic and Gulf States, where the chase is, or was, a favorite pastime,

the hunter can judge, with considerable probability, where the deer will pass when running before the hounds. Thus in a given area,—a township we will suppose,—the deer will cross a creek in one or two of half a dozen regular crossings; or he will pass one of a limited number of known glades or openings in the general forest. But in Texas this did not hold good. Either the deer had no regular passing places, or they had so indefinite a number that the hunters were not able to discover them. Perhaps this difference comes from the fact, that running deer with hounds had never been practised there, and they had not become used to it. The hunters were quite at a loss where to station themselves in order to get a shot at the chase.

It may not be irrelevant to describe the process of dressing deer-skins, which furnish the material used in the manufacture of buckskin gloves. There are three principal operations: graining, braining, and smoking. The first is mechanical; the other two effect some chemical change which I am unable to explain satisfactorily. The skin is dried and afterwards soaked till it is soft; then the hair and grain, or cuticle, are rubbed off with any instrument serving the same purpose as a currier's knife, the skin being spread out on anything answering to the currier's beam. The skin is partially "broken" in this process, and it should be stretched and broken still more, while drying, that it may "take brains" more readily. The brains of the deer, or any similar quantity of another animal will dress the skin.* These are thoroughly dissolved in a half pailful of warm water. The skin, immersed in it, soon absorbs the brains and becomes thick and spongy. It should be stretched in all directions, carefully, that no spot may be left unaffected, otherwise that spot will remain hard. It is known when the skin is brained in this manner. Gather up a fold of the

* The same effect is produced by saturating the skin in oil, and then washing it out with strong soap and water. The bruised or crushed root of *Yucca filamentosa* is also used; and the seeds of *Sapindus saponaria* (soap berry) would, probably, answer the same purpose.

skin into the form of a sack or bladder, and blow into it or inflate it; then, closing the orifice and pressing upon the sack, the included air will pass out through innumerable pores, making a spray from the particles of contained water. Wring out all the water possible, and stretch and rub it as before, while drying, when it will become white and soft. If stretched in a suitable frame, nearly to its natural shape, and rubbed with a wedge-shaped stick, the labor is less and the skin is smooth and even; otherwise it will remain more or less wrinkled,—some parts unduly, others not sufficiently stretched. But if the skin be now wetted and suffered to dry without manipulation, it becomes hard again like rawhide. Smoking is a means of obviating this. The object is to make the smoke pass through the pores of the skin. The effect of the braining seems to be to comminute the gluten, but it does not affect its solubility. The smoke seems to form a chemical combination with it, rendering it insoluble. Any dry rotten wood,—hickory, ash, oak, or even cobs,—serves to make the smoke. A hole is dug in the ground about two feet deep and six inches in diameter. Some coals are thrown in and a little of the wood upon them. The skins (better two together) are loosely sewed along the edges, except one, which is stretched around the hole, and the skins are then suspended above it, much like an empty sack with the mouth downward. The smoke in its ascent fills the sack and passes through or penetrates its substance. The process is kept up till the operator deems the skin sufficiently smoked. Now, if they are wetted, they dry soft without manipulation. There is still an operation which improves them, though not necessary. It is a species of tanning. Willow-bark, or that of sassafras is good, as it does not stain clothing, which is spotted by the ooze of oak when the skin is wet and comes in contact with it. We boil a small quantity of bark, and dip the skins into the ooze for a few minutes; wring them as dry as possible and the operation is finished. Treated in this way, the skin becomes one of the strongest textures we

know of. But in its original state, a skin of ordinary size is easily torn into strips. When dressed, the fibres being loose, come gradually into parallelism, and the tension is resisted by many at once. Previously, held to its place by the gluten, each fibre, acting singly, was readily broken.

Here is a problem for hunters. *With a single bullet, to shoot a deer through the heart and break both fore legs, one of them just above the foot.* It has been solved. But how?

THE HABITS OF SPIDERS.

BY J. H. EMERTON.

EVERY reader of the NATURALIST has noticed the round, regularly formed spider-webs which often adorn the corners of fences, and the windows of neglected buildings; but few, perhaps, have had time or patience to watch the skilful manner in which they are constructed, or to examine the apparatus by which the spider spins the thread out of her own body. The builders of these webs belong to a large family of spiders, the Epëiridæ. They are found in all parts of the world where winged insects, which form their food, abound.

To illustrate the habits and structure of these spiders, we will select one common species as a representative of the whole group, and confine our observations to it. This species, the *Epëira vulgaris* of Hentz, seems to be common all over the United States, and is represented by closely related species in other countries. It is seldom found in the woods and fields, but lives in great numbers on garden fences and trellises; in barns, and on the framework of bridges, the structure of which affords numerous crevices for shelter and concealment. When fully grown it is half an inch in length, and its feet, when extended, will cover a circle an inch and a half in diameter. It is clothed with hair of a greyish

color, the back is ornamented with various whitish markings, and the legs with rings of black and yellow. The under side of the body is black, with yellow markings. In sheltered places they spend most of the time in their webs waiting for prey, while in situations exposed to the sun and wind they watch only in the night. During the day, and in stormy weather, they remain concealed in some crack or corner, near which, for convenience, the web is always placed. In such retreats they also pass the winter without food, and only covered by a thin web of their own spinning. Like other spiders they are furnished with poisonous jaws, which they attempt to use when disturbed, but as they can only bite what comes directly between their jaws, they may be handled without fear. There are but few cases on record of a spider biting the human skin. Their timid nature leads them to avoid danger rather than resist it, and the common suspicion with which they are regarded has no foundation, except a want of acquaintance with their habits.

If we take a spider of the kind just described and turn it under side up, as in Pl. 11, fig. 2, we shall at once notice that the body consists of two nearly equal parts, connected by a slender waist. The front part gives origin to the organs of sense and motion, while the hinder part contains the principal internal organs. The most conspicuous appendages of the body are the four pairs of legs (Fig. 2, *a, a, a, a*). Immediately in front of these is another smaller pair (Fig. 2, *b*, and fig. 7), the first joints of which are flattened, so that they may be used as jaws, or lips (Fig. 2, *c*), for squeezing the food. The ends of these last limbs are supposed to be organs of touch, and are called palpi. Next in front is a pair of stout jaws (Fig. 3, *c, c*), each of which is furnished with a sharp claw at the end (Fig. 3, *a*). This claw is hollow, and is pierced with a minute hole near the point (Fig. 3, *b*). When the spider bites, a drop of poison is discharged through this orifice from a gland in the head. This quickly kills insects, and causes inflammation of the bitten part in larger

animals. On the front of the head are the eight eyes, four near together in the centre, and a pair on each side (Fig. 3).

The feet of spiders are wonderfully adapted for walking on the web. Each foot is furnished with three claws (Fig 6, *a*, *b*, *b*), the middle one of which (*a*) is bent over at the end, forming a long finger for clinging to the web, or for guiding the thread in spinning. The outer claws (*e*, *e*) are curved and toothed like a comb. Opposite the claws are several stiff hairs (Fig. 6, *c*) which are toothed like the claws, and serve as a thumb for the latter to shut against.

The spinning organs are three pairs of fleshy appendages situated at the posterior end of the body (Fig. 2, *e*). When not in use they are folded in towards each other, the third pair covering the second. When expanded, they appear as in Fig. 4. The end of each of these spinners (*s*, *s*) is covered with minute jointed tubes, like Fig. 5, which represents one tube much enlarged. Inside the spider, and connected with the spinners are several bunches of glands, which secrete a liquid like the white of an egg. To form the thread this liquid is drawn through the tubes, which divide it into such small fibres that it dries almost immediately on coming in contact with the air. The spider has the power of uniting these fibres into one or several threads, according to the purpose for which they are to be used. The thread commonly used for the web is composed of hundreds of simple fibres, each spun through a separate tube. As the thread runs from the body, it is guided by the hind feet, which hold it off from contact with surrounding objects, until the desired point is reached, when a touch of the spinners fastens it securely.

When a spider wishes to build a web she usually selects a corner, so that the structure may be attached on several sides. She then runs a few threads along the objects to which the web is to be fastened, to facilitate her passage from point to point. The web is commenced by a line or two across the point where the centre is to be, which is not usually the geometric centre, but nearer the top than the

bottom. Radiating lines (Pl. 11, fig. 1, *b*, *b*, *b*) are then spun from the centre in all directions. In doing this the spider often crosses from one side of the web to the opposite, so that the finished portion is always tightly drawn, and the tension of the completed web is the same in every part.

Having finished the framework, the spider begins near the centre and spins a thread (Fig 1, *c*, *c*, *c*), spirally, around the web to the circumference, fastening it to each radius as it crosses. The distance between the spirals varies with the size of the spiders, being about as far as they can reach. This spiral thread serves to keep the parts of the web in place during the rest of the process, and is removed as fast as the web is finished. It also furnishes a ready means of crossing from one radius to another where they are farthest apart. All the thread spun up to this stage of the process is smooth when dry, and will not adhere if touched with a smooth object.

The spider having thus formed the web, begins to put in the final circles at the outside, walking around on the scaffolding previously prepared, which she gradually destroys as she proceeds, until in the finished web only a few turns in the centre are left. The thread of the circles last spun is covered with viscid globules, strung upon it like beads at short distances. If an insect comes in contact with the thread, it immediately adheres, and its struggles only bring a larger part of its body into contact with the web. Dust and seeds also stick to the web, so that in a single day it is often so clogged as to be of no farther use. The web also becomes torn by the struggles of the prey, and by wind and rain, so that it requires repair or renewal every night. In mending a web the spider usually removes all except the outside threads, biting them off and rolling them into a hard ball between her jaws, so that when released it will drop quickly to the ground. This probably gave rise to the opinion, sometimes advanced, that the old web is eaten by the spider.

When the web is finished she stations herself in the centre, where a small circle is left free of the adhesive threads.

Her usual position is head downward, with each foot on one of the radii of the web, and the spinners ready to fasten themselves by a thread at the least alarm. She often remains in her hole with one foot out, and resting on a light thread connected with the centre of the web, so that any vibration is quickly detected. If the web be gently touched the spider will rush into the centre, and face towards the disturbed part. She will then jerk smartly several of the radii leading in that direction, to see if the intruder is a living animal. If this test is followed by the expected struggle she runs out towards the victim, stepping as little as possible on the adhesive threads, seizes it in her jaws, and as soon as it begins to feel the effects of the bite, envelops it in a silken covering, and hangs it up to suck at her leisure. In spinning this envelope the insect is held and turned around mainly by the short third pair of feet, while a flat band of threads is drawn from the spinners by the hind pair working alternately like the hands in pulling a rope, and wound over it in every direction, so that in a few seconds it is so covered as to be unable to move a limb. When a web is shaken by the wind, the spider will sometimes draw in all her feet toward her body, thereby tightening the web in every direction so that the vibration is prevented.

The construction of nets for catching food is not the only use of the thread made by these spiders. They seldom move from place to place without spinning a line after them as they go. They are able by its use to drop safely from any height, and when suspended by it are carried by the wind across wide spaces without any exertion on their part, except to let out the thread. The crevices in which they pass the winter, and the leisure hours of summer, are partly lined and enclosed by a coating of silk resembling that used for confining captured insects. The eggs are enclosed in a cocoon of the same material, and there the young remain until they are strong enough to shift for themselves, growing to nearly double their size without apparent nourishment.

EMERTON ON THE SPIDER.

Several hundred young are produced by a single female, but probably it is seldom that one-tenth of this number ever reach adult size. Nearly all the spiders which we see in webs are females, or young. They spend most of their time in the vicinity of their webs, and many doubtless pass their lives within a few yards of the place of their birth. The adult males are seldom seen building or occupying webs: they remain concealed during the day, and at night wander about from web to web. When young, there is no obvious difference between the sexes, but as the time for the last moult approaches, the ends of the palpi of the male swell to several times their former size. When the time for the final moult arrives, both sexes retire to their holes and cast off the skins of their entire bodies, even to the claws. This process obliges them to remain concealed until the new skin has acquired sufficient strength and firmness, when they again return to their webs. The females still resemble the young, except in size, but the males are distinguished from them by the greater length of their limbs, the diminished size of the posterior half of the body, and the large and complicated joints at the ends of the palpi (Pl. 11, fig. 8). The females of some species of spiders are said to devour the males whenever opportunity offers, but we have never noticed that habit in this species, though we have often seen a female charge upon an intruding male, and chase him from her web.

EXPLANATION OF PLATE XI.

Fig. 1. Circular web; one-fourth the natural size.
Fig. 2. *Epëira vulgaris* Hentz, natural size, under side; *a*, legs; *b*, palpi; *c*, jaws; *e*, spinners.
Fig. 3. Front view of head, showing eyes and jaws; *a*, tooth on the end of jaw; *b*, orifice for the discharge of poison.
Fig. 4. Spinnerets spread apart for use, showing the cluster of tubes on the end of each, enlarged twenty-five diameters.
Fig. 5. One spinning tube, still more enlarged.
Fig. 6. Foot; *a*, the middle claw; *b*, *b*, the two outer claws; *c*, toothed hairs.
Fig. 7. Palpus of female or young.
Fig. 8. Palpus of adult male.

REVIEWS.

Dr. Hooker's Address at the Norwich Meeting of the British Association* should be read by every reader of the Naturalist. The Study of Man, Anthropology and Ethnology, Fossil Botany, Darwinism, and the more practical subject of the proper arrangement of museums are discussed. We quote at length, first, as regards the discovery of a race of existing cromlech-builders:

"It will, no doubt, surprise many here to be told that there exists within three hundred miles of the British capital of India a tribe of semi-savages, who habitually erect dolmens, menhirs, cysts and cromlechs, almost as gigantic in their proportions, and very similar in appearance and construction to the so-called Druidical remains of Western Europe; and, what is still more curious, though described and figured nearly a quarter of a century ago by Colonel Yule, the eminent Oriental geographer, except by Sir J. Lubbock, they are scarcely alluded to in the modern literature of prehistoric monuments."

Read the sensible remarks of Dr. Hooker on Museums, their arrangement and objects:

"Much as has been written upon the uses of museums, I believe that the subject is still far from being exhausted; for in the present state of education in this country, these appear to me to afford the only means of efficiently teaching to schools the elements of zoology and physiology. I say in the present state of education, because I believe it will be many years before we have schoolmasters and mistresses trained to teach these subjects, and many more years before either provincial or private schools will be supplied with such illustrative specimens as are essential for the teacher's purposes. Confining myself to the consideration of provincial and local museums, and their requirements for educational purposes, each should contain a series of specimens illustrating the principal and some of the lesser divisions of the animal and vegetable kingdoms, so disposed in well-lighted cases as that an inquiring observer may learn therefrom the principles upon which animals and plants are classified, the relations of their organs to one another and to those of their allies, the functions of those organs, and other matters relating to their habits, uses and place, in the economy of Nature. Such an arrangement has not been carried out in any museum known to me, though partially attained in that at Ipswich; it requires some space, many pictorial illustrations, magnified views of the smaller organs and their structure, and copious, legible, descriptive labels; and it should not contain a single specimen more than is wanted. The other requirements of a provincial museum are,—complete collections of the plants and animals of the province, which should be kept entirely apart from the instructional series, and from everything else.

"The curator of the museum should be able to give elementary demonstrations (not lectures and quite apart from any powers of lecturing, that he may possess) upon this classified series to schools and others, for which a fee should be charged, and go to the support of the institution. And the museum might be available (under similar conditions of payment) for lectures and other demonstrations. Did such a museum exist in Norwich, I am sure that there is not an intelligent schoolmaster in the city who would not see that his school profited by the demonstrator's offices, nor a parent who would grudge the trifling fee. You boast of a superb collection of birds of prey! how much would the value of this be enhanced were it accompanied by such an illustration of the nature, habits, and affinities of the Raptores as might well be obtained by an exhibition of the skeleton and dissected organs of one hawk and one owl, so laid out and ticketed that a school-boy should see the structure of their beaks, feet, wings, feathers, bones, and internal organs—should see why it is that hawks and owls are pre-eminent among birds for powers of sight and of flight; for circling and for swooping; for rapacity, voracity, and tenacity of life,—should see, in short, the affinities and special attributes of birds of prey? This, which refers to the teaching of natural history, is an operation altogether apart from training the minds to habits of exact observation, which, as is not fully admitted, is best attained in schools by Professor Henslow's method of teaching botany.

* Every Saturday, Sept. 26. Boston, Ticknor & Fields. Price 10 cents.

"Excellent manuals of many branches of geology are now published, which are invaluable to the advanced student and demonstrator; but from which the school-boy recoils, who would not refuse to accept objects and pictures as memory's pegs, on which to hang ideas, facts, and hard names. To school-boys, skeletons have often a strange fascination, and upon the structure of these and the classification of the vertebrata much depends. What boy that had ever been shown their skulls would call a seal or porpoise a fish, or believe a hedgehog could milk cows, as I am told many boys in Norfolk and Suffolk, as elsewhere, do believe implicitly? A series of illustrated specimens, occupying some 5,800 feet of wall-space, would give at a glance a connected and intelligible elementary view of the classification and structure of the whole animal kingdom; it would stand in the same relation to a complete museum and *Systema Naturæ* as a chart on which the principal cities and coast-lines are clearly laid down, does to a map crowded with undistinguishable details."

Dr. Hooker then touches upon his favorite study, botany, closing with a defence of Darwinism:

"In my own special science the greatest advances that have been made during the last ten years have been in the departments of Fossil Botany and Vegetable Physiology. In the past history of the globe two epochs stand prominently out—the carboniferous and the miocene—for the abundant material they afford and the light they throw on the early conditions of the vegetable kingdom. Why plants should have been so much more lavishly preserved during these than during some of the intervening or earlier epochs we do not rightly know; but the comparative poverty of the Floras of the latter is among the strongest evidences of the imperfection of the geological record. Our knowledge of coal plants, which since the days of Sternberg, Brongniart, and Lindley and Hutton, has been chiefly advanced by Göppart and Unger on the Continent, and by Dawson in Canada, has received very important accessions of late through the untiring energy of Mr. Binney, of Manchester, who has devoted nearly thirty years to the search for those rarely found specimens which exhibit the internal structure of the plant."

"Passing to the tertiary times, the labors of Count Saperte in France, of Gauden and Strozzi and of Massolonghi in Italy, of Lesquereux in America, and, above all, of Heer in Switzerland, have, within the last ten years accumulated vast numbers of species of fossil plants; and if the determination of the affinities of the majority are trustworthy, they prove the persistence throughout the tertiary strata of many interesting families and genera, and the rarity of others than these. Here, however, much value cannot be attached to negative evidence. Almost the only available materials for determining the affinities of the vast majority of these tertiary plants are their mutilated leaves, and, unlike the bones of vertebrate animals and the shells of mollusks, the leaves of individual plants are extremely variable in all their characters.

"Furthermore, the leaves of plants of different natural families and of different countries mimic one another to such a degree that, in the case of recent flowers, every botanist regards these organs as a most treacherous guide to affinity. Of the structural characters which are drawn from the internal organs of plants, and especially from their fruit, seeds, and flowers, few traces are to be found in the fossils, and yet it is from them exclusively that the position of a recent plant in the vegetable kingdom can be certified."

"Heer's labors on the miocene and pliocene Floras, especially, are of the highest value and interest. His conclusions regarding the flower of the Bovey Tracy coal-beds (for the publication of which in a form worthy of their value and of their author's merit we are indebted to the wise liberality of Miss Bardett Coutts) are founded on a sufficient number of absolute determinations; and his more recent *Flora Fossilis Arctica* threatens to create a revolution in tertiary geology. In this latter work Professor Heer shows, in apparently unassailable evidence, that forests of Austrian, American, and Asiatic trees flourished during miocene times in Iceland, Greenland, Spitzbergen, and the Polar American Islands, in latitudes where such trees could not now exist under any conceivable conditions or positions of land or sea or ice, and leaving little doubt but that an arboreous vegetation once extended to the Pole itself. Discoveries such as these appear at first actually to retard the progress of science by confounding all previous geological reasoning as to the climate and condition of the globe during the tertiary epoch."

THE GEOLOGY OF NEW YORK.*—Besides papers on Climatology and Meteorology, there is an important investigation upon the internal appen-

*Twentieth Annual Report of the Regents of the University of New York. 8vo, pp. 410. Albany, 1867. With twenty-five plates.

dages of the genus Atrypa, by R. P. Whitfield. Professor Hall's contributious to Palæontology include a compendious extract from his work on the Graptolites (Decade ii, of the Canadian Geological Survey), extracts from Vol. 4 of the Palæontology of New York, and observations on the Niagara limestone of Wisconsin and Illinois. The extracts are principally notices of the generic characteristics of the Devonian genera, filled with facts of the greatest value to the student of this group, and the observations trace the relation of the Niagara group, of New York, to the Guelph limestone of Canada, and the limestones of Racine and Le Claire in Wisconsin, which are said to be identical with a thin bed of limestone in Wayne county, New York, formerly referred to the Onondaga Salt Group. The lithographer has not, apparently, done full justice to Mr. Whitfield's masterly drawings, but all the plates are good, and some deserve high praise.

NATURAL HISTORY MISCELLANY.

BOTANY.

VARIATION IN WILD PLANTS.—Cultivation gets more credit for producing variation in species than I think it is fairly entitled to. The production of double flowers is especially referred to the gardener's art. I think this is rarely the case. Double Buttercups (*Ranunculus acris*, *R. bulbosa*, and *R. ficaria* all have double forms) could scarcely result from cultivation, as they are too common to be ever a cultivated plant. Yet we rarely see any tendency in this direction in wild plants. The only one I ever found double was a *Saxifraga Virginiensis*, in a shady wood on the Wissanickon, some fifteen years ago. It was transplanted to my garden, but destroyed the same season by a careless laborer. Has any other double flower been found?—T. MEEHAN.

Saxifraga Virginiensis was found full-double at Danvers, Mass., three years ago, and it continues so from year to year. It is well worthy of the florist's attention. Incipient doubling is not uncommon in a considerable number of wild flowers; but the process of doubling is doubtless accelerated under the conditions which attend cultivation.—A. GRAY.

ZOÖLOGY.

THE MCNIEL EXPEDITON TO CENTRAL AMERICA.—In May last, Mr. J. A. McNiel, an enthusiastic and ardent naturalist and indefatigable collector, started on his expedition, under the immediate auspices and direction of the Peabody Academy of Science. Arriving at Panama he was cordially received, and aided by the officers of the Panama Railroad and

Pacific Steamship Company, who gave him much desirable information, and helped him in his work in every way in their power. To William Nelson, Esq., Commercial Agent at Panama, he is much indebted for assistance received; and from Captain Dow (who is well known as an ardent lover of Natural History, and who has sent many rarities to various museums) he received marked attention and kindly aid; and Captain Douglass of the steamer Guatemala, and his officers, were most courteous to him during his trip from Panama to the port of Coriuto (formerly Realejo), Nicaragua, at which place he made his first collections. He here had the good fortune to meet with Captain Emmons, of the U. S. sloop of war Ossipee, who, with his officers, kindly assisted him in his marine collecting. After a stay of a few weeks at this place, Mr. McNiel went into the interior and collected for about a month on and near the Rio Gigillillo, where he was most hospitably entertained by Don Ycidro Ycaza. He here collected a large number of insects, comprising about 3,000 butterflies, which were packed in papers, and large quantities of other orders in alcohol; together with about 1,500 unios, and about a bushel of various species of land and fresh-water gasteropods, with many other species of various classes. He then returned to the coast to forward his specimens to the Academy, where they have arrived in safety. At the date of his last letter he was on the eve of departure for the interior again.

We take great pleasure in making this public acknowledgment of the uniform assistance and courtesy extended to Mr. McNiel by the various gentlemen whom he met, as it is most gratifying to the naturalist to feel that he is every day meeting more and more with the sympathy and encouragement of educated men, and that the dark days of science, when a naturalist was looked upon as a person a little out of his proper mind who spent his time "Bug-hunting," is now buried in the past, and that henceforth a man can run after a butterfly, or bespatter himself with mud, in his attempts to obtain some desired inhabitant of the ditch, without feeling that he is looked upon by his fellow-men as a "natural" instead of a naturalist.

It is the intention of Mr. McNiel to spend about two years collecting in Central and the northern part of South America, and from the way in which he has commenced, we feel sure that science will be largely indebted to him for much that is new and important from that most interesting region.

As there are no funds of the Academy that can be devoted to such an expedition, we shall have to depend upon the liberality of the friends of science, and the sale of part of the specimens for its maintenance. On the receipt of specimens at the Academy they will be at once arranged, and after selecting a series for the "McNiel Collection" of the Academy, the rest will be offered for sale, and special investigators can secure the specimens relating to their departments, by addressing the Director of the Academy. Donations in aid of the expedition are also solicited. Any party aiding the expedition will receive an equivalent in specimens if

desired, as well as the thanks of the Academy. We shall from time to time call attention in the NATURALIST to the progress and results of this expedition.—F. W. PUTNAM, *Director*, *Peabody Academy of Science*.

THE SHELLS OF MONTANA. *Helix Townsendiana* Lea.—Numerous small specimens were found in the dry prairie at the junction of Hell Gate and Bitterroot rivers, and as I found larger ones of various sizes in more damp situations of the woods, from an elevation of 4,800 feet down to 2,200, at the west base of the Bitterroot range, I presume this is a dwarfed variety, such as is found also west of the Coast Mountains, in Washington Territory. It is the most wide-spread species I have seen there.

Triodopsis Mullani Bland & Cpr.—A single dead specimen, of a beautiful semitransparent yellow, resembling *H. tridentata* in size and form, I found here under a stone, and afterwards found in small numbers at the west side of the Bitterroot crossing, forty miles distant.

Helicodiscus? polygyrella Bld. & Cpr.—This beautiful little one-toothed species I found common on the Cœur d'Aleñe Mountains, especially their east slope, inhabiting moss and decaying wood in the dampest part of the spruce forests.

Anguispira Cooperi W. J. B.—This fine species I found only on the east slope of the dividing ridge of the Rocky Mountains, at an elevation between 5,500 and 6,000 feet above the sea! From the dryness of the season (Aug. 10) I presume I could find none moving about, and but one alive. Most of them were about the roots of *Geranium incisum*, a species abundant on both slopes, but I looked for Helices in vain in the other.

Anguispira solitaria Say (or *A. Cooperi* var?).—The large globose lipless Helix inhabited both slopes of the Cœur d'Aleñe Mountains, above 2,500 feet elevation, preferring the openings in the forest covered with bushes and ferns.

Anguispira strigosa Gould.—I was always on the lookout for Helices, and up to August 31st found none along the Bitterroot river except rarely *H. Townsendiana*. That day, however, at a hill called "Half-way," thirty miles below the junction, I found two additions to the list. The larger, flattened, banded and somewhat carinated form, I found *æstivating* under logs of pine on a steep shaly slope containing lime in veins.

Hyalina arborea Say; *Patula striatella* Anth.—Found in damp bottom land along Hell Gate river, about 4,800 feet above the sea, living on decayed logs, etc. Not seen elsewhere.

Lymnæa palustris Linn.; *L. bulimoides* Lea.; *L. desidiosa* Say; *Physa heterostropha* Say.—Missouri river above the falls, about 3,000 feet above the sea. August, 1860.

Lymnæa palustris Linn.; *L. humilis* Say; *Bulinus hypnorum* Linn.; *Physa heterostropha* Linn.—Hell Gate river, west slope of the Rocky Mountains, 4,800 feet above the sea. August 14, 1860.

Planorbis trivolvis Say; *P. parvus* Say.—Bitterroot river.

Sphærium striatinum Linn.; *Unio luteolus* Lamk.; *Margaritana arcuata* Gould.—Missouri river above the falls. Also found in Spokan river, below

Lake Cœur d'Aleñe, and at the ferry over that river. They can be seen in the clear water several feet beneath, completely covering the bottom like mussels (*Mytili*) on shoals along the seashore, standing edgewise among the large stones.

Sphærium occidentale Prime.—Spokan river, September 1860.

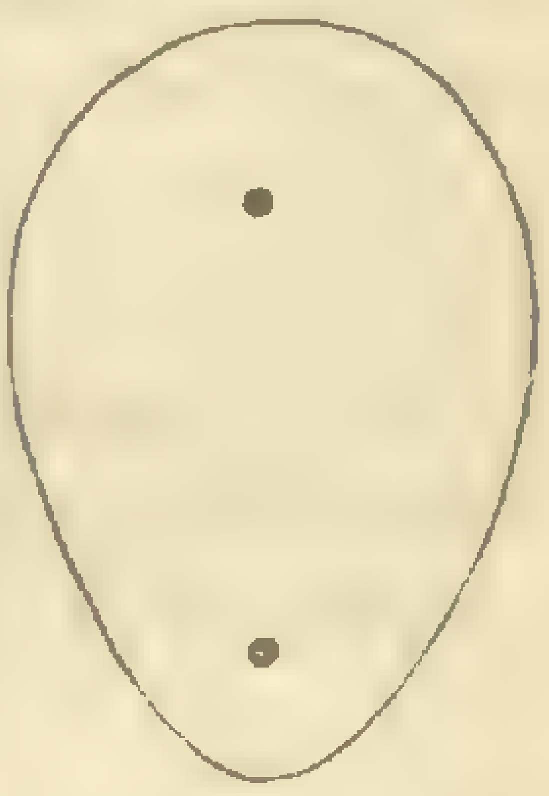
Unio Oregonensis Lea?—I saw a few valves in Spokau river, below the upper falls.

Ancylus Kootaniensis Baird.—Spokan river, below lower falls, on stones, September, 1860; common.—J. G. COOPER, M. D.

HINTS ON OÖLOGY.—In every branch of natural history, collections must be formed and suitably classified to enable the student to compare one specimen with another, and thus secure to science the benefit arising from his speculations. The mere collecting of specimens, it is true, has become one of the least of the objects desired by scientific men, yet in no branch of scientific pursuit is there more need of care and accuracy, than in the collection and identification of specimens of natural history. And especially is this true in an oölogical collection, where the identification of each specimen ought to be the main object of the collector.

The easiest and most satisfactory method of identifying a nest of eggs, is by shooting or catching one or both the parent birds to which the nest belongs, but at times this is impossible and other means must be sought. Examine carefully the situation of the nest, of what materials it is composed: notice the locality, what species frequent it, and make a record of these and kindred observations in a note-book. In this manner the true species may often be discovered. The proper method of preserving eggs next invites our attention. Eggs must be emptied of their contents, as they are liable to swell and burst the shell if handled. The most convenient way of effecting this, is to drill two small holes on the side (Fig.1), and not at each end, as is the more common method. Having done this, apply the mouth or a small blowpipe at the smaller hole, forcing the contents out of the larger. If it contains an embryo, force out as much as possible without breaking the shell, and, with a small glass syringe, partly fill the shell with water and make another attempt. If this is impossible, carefully enlarge the hole, and by means of a sharp penknife and small wire hook, the largest embryo may be successfully removed. The ingenuity of the operator will easily provide means for special difficulties, but in no case should an egg be left partly emptied, as it will immediately attract insects and ruin the specimen. The only instrument absolutely required are small drills and a syringe, though, when convenient, the use of blowpipes and elongated scapels will be very useful. It is considered a good plan to hold the egg over a basin of water when blowing it, that it may not be injured if it slips from the fingers. Some oölogists preserve the nest of the bird with the eggs, and, when practicable, the parent bird. Eggs should be carefully marked when laid aside, that no mistakes may

Fig. 1.



arise. Different collectors prefer different methods of doing this. Perhaps the best is to mark the egg, on the same side as the holes, with a quill pen. This should be done in neat letters, the name of the species, and the number, referring to the collector's note-book, which should contain full data in respect to the identification, time and place where secured, etc. Both the English and scientific name should be given. Many persons use very fine sawdust to lay their egg on, but this has a tendency to destroy the shells and ruin the specimens. Cotton is very good and is also employed by many. Eggs, when mounted on strips of cardboard, may be preserved in a neat and secure manner. They should be kept beneath a glass-case, free from the rays of the sun, which cause the natural tint or "bloom" to fade and loose its freshness. The student of nature cannot find a more interesting branch of scientific investigation, than that which pertains to those objects which are presented to his vision from day to day. The habits of the birds of North America, and their manner of building their nests and rearing their young, affords an opportunity of careful and minute study. The song-birds of New England are not the least of its many attractions, and the student who will make himself more conversant with their oddities, will find a world of beauty opening before his astonished gaze.—G. R. METCALF.

THE "DWARF THRUSH" AGAIN.—In the NATURALIST, for June of this year, Mr. E. A. Samuels gives a notice of the "Dwarf Thrush (*Turdus nanus*) in Massachusetts," the specimen referred to being taken in Waltham, by Mr. L. L. Thaxter. In the September number Mr. T. Martin Trippe mentions that he has obtained a bird of the same species (*T. nanus*) near Orange, N. J. The specimen described by Mr. Samuels being brought to me for identification, I had an opportunity of examining it several months before Mr. Samuels's notice of it appeared in the NATURALIST, and I unhesitatingly pronounced it a young bird (probably of the first year) of *Turdus Swainsonii*, it differing from average specimens of this species only in its rather unusually small size, and in certain well-marked characters of immaturity. After Mr. Samuels's account of it appeared, fearing I might have been mistaken, I sent to Mr. Thaxter for the specimen, and through his kindness was enabled to give it a reëxamination. The result was the entire confirmation of my previous conclusion. Mr. Samuels, it will be observed, only compares it with *T. Pallasii*, from which in every way, it is clearly distinct, as he supposed; and hence, from its small size, he hastily concludes it must be the *T. nanus*, which I am sure he would not have done had he also compared it with *T. Swainsonii*. The specimen mentioned by Mr. Trippe, according to his description of it, does not appear to differ much from frequent specimens of *T. Pallasii*, though considerably, as he observes, from the description Mr. Samuels gives of his. As to *T. nanus*, if it be a distinct species, the specimen described by Mr. Trippe might perhaps be referred to it, though *T. nanus* has been supposed to be a western species, representing on the Pacific slope the *T. Pallasii* of the Atlantic. In a paper (now in press) in

the Memoirs of the Boston Society of Natural History, in which we give, incidentally, a review of this group of our Thrushes (sub-genus *Hylocichla* Baird. Review Am. Birds, 1864, p. 12), we attempt to show that it is not a species distinct from *T. Pallasii*, and that specimens entirely referable to it are of occasional occurrence in the Eastern States. *T. Audubonii* is also referred to *T. Pallasii*, *T. ustulatus* to *T. fuscescens*, and *T. Alliciæ* to *T. Swainsonii*. For a more detailed notice of Mr. Samuels's specimen, and a discussion of the nature and relations of these supposed species, the reader is referred to the paper above cited (Mem. Bost. Soc. Nat. Hist., Vol. I, p. 508, *et. seq.*).

Respecting the "bluish purple tinge" presented by the tail feathers of both Mr. Trippe's and Mr. Samuels's specimens, it is a character of no uncommon occurrence in all the Thrushes, as well as in the Fox-colored Sparrow (*Passerella iliaca*), the Song and other Sparrows and birds possessing a rufous tail, especially in young birds and in those that have recently moulted, not being a specific character at all, but generally a mark of fresh plumage.—J. A. ALLEN, *Cambridge*.

THE BARN OWL IN PENNSYLVANIA.—During the last year we have captured the "Barn Owl" (*Strix pratincola* Baird) in a high church steeple in this city (Lancaster), which is almost as rare a bird in this latitude as the Golden-eagle, although I am informed that it is more common in Maryland and Virginia. I visited their nesting place and obtained some of their voided pellets, four eggs, and two of their young,—the one just before its exclusion from the egg, and the other when it was six weeks old. So rapid is the development of this bird, that in six weeks it had increased, from less than a half ounce in weight to more than a pound, and in volume, to near the size of the adult. When it was prepared and mounted, the pin-feathers were just appearing in the wings and tail; otherwise, it looks like a mass of white cotton wool, or down, with formidable feet, beak, and eyes "stuck in," after the manner of making toys. Although I visited this "owlery" on several occasions, I never found the adults "at home," and the eggs were always exposed and quite cold. The young were excluded about the 27th of September. The pellets were composed of the bones and hair of mice and moles.—S. S. RATHVON, *Lancaster, Pa.*

WILSON'S SNIPE.—In reply to a note contained in the Natural History Miscellany, stating that W. A. Pope "has observed the *Scolopax Wilsonii* sitting on the top of a tree, at least thirty feet from the ground," and asking "if other ornithologists have observed this peculiarity," we would state that we once flushed a snipe which flew from the ground and immediately perched on the dry limb of a tree about twenty feet high, from which we shot the bird, induced by its extraordinary position, although contrary to our principles and practice as a sportsman. An old hunter, present on the occasion, averred that he had witnessed more than once a similar departure from the ordinary habits of the snipe.—J. M. H., *Kalamazoo*.

Carbolic Acid for Preserving Insects, etc.—During the present summer I have used as a preservative fluid, an alcoholic solution of carbolic acid,—about four grains to the ounce. After killing the insect with chloroform, which I prefer, I thoroughly paint it with this preservative fluid and then dry it in the sun. During the past two months I have had a number of insects thus prepared, mostly Lepidoptera, pinned to the wood-work in my office, thus freely exposed during a season which has been very favorable for their destruction, and they now look as fresh and beautiful as on the day they yielded themselves as martyrs to the cause of science. I am well pleased with the action of carbolic acid, and feel satisfied that it is a sure protection and preservation. In stuffing animals, I use cotton soaked in this same alcoholic solution. Neither do I think it necessary to skin them as formerly, but simply remove the contents of the thorax and abdomen. Specimens prepared thus, a month ago, are now in good condition.—S. B. P. Knox, M. D., *Brownsville, Pa.*

Albino Robin.—On the 19th of September, 1868, I shot at Marshall, Michigan, and preserved a specimen of *Turdus migratorius*, which is nearly white. The wing quills and tail are a creamy or soiled white. The upper parts darker, inclining to ash, and the breast and under parts lemon color, with the tips of the feathers white. Bill and feet bright yellow; eyes black. The general appearance of the bird when flying was white. Throat pure white.—D. Darwin Hughes.

Kingfisher's Nest again.—I examined two in Ohio; the entrance to the first was on the west side of a bank, some twenty inches from the surface, the tube did not curve, but was so straight that I could plainly see the nest, which was about twenty-eight inches from the mouth of the tube. The second was fully four feet deep, but straight as the other. I did not then notice the substance of the nest. The nests were somewhat higher than the mouths. Both contained young, the first seven and the second four.—P. G. March, *New York.*

The Cow-bunting.—It would, perhaps, be interesting to know how many of our birds the Cow-bunting chooses as foster parents to her young. During the present season I have known the eggs of this bird to be found in nests of the *Sayornis fuscus* (Common Pewee), *Empidonax Acadicus* (Green-crested Flycatcher), and *Icteria viridis* (Yellow-breasted Chat), three species which I never knew to be imposed upon before. It is rather unusual for the Cow-bird to choose nests of the true Flycatchers, in which to deposit its eggs, these birds frequently deserting on very slight provocation.

I once found a nest of the *Pyranga rubra* (Scarlet Tanager), with the female sitting upon two eggs of the Cow-bird. On returning to the spot a few days after, for the purpose of obtaining the eggs of the owner, I was greatly surprised to find two young Cow-buntings in a flourishing condition, but no sign of a Tanager's egg. This was to me quite a new phase in the domestic affairs of birds,—one species building the nest while another furnished the eggs.—T. H. Jackson, *West Chester, Pa.*

MIGRATION OF ANTS.—On the 17th of June, 1866, I noticed that the ants around my door were unusually numerous and active. They were not running about at random as if hunting for food, but kept in a path a few inches wide, which extended from the door into a neighboring yard. Some of the ants appeared to have unusually large heads, but on closer examination it appeared that each carried another ant in her jaws. If a pair of these were separated they ran about as if dizzy, rubbing their antennæ with those of every ant they met. When they had recognized each other by this means of communication, they clasped their jaws together, and raised their heads as high as possible from the ground. The ant, who was to be carried, then curved her body under the head of the other, and drew her feet close to it, so as to hang entirely free from the earth. In this position they were carried with very little difficulty, being entirely out of the way of the limbs of their carriers. Tracing the line of march I found it extended to the door-step of a neighbor, some twenty yards off, passing under a gate and over a step four inches high, and through several yards of ground covered with weeds and ashes. Every ant which left our neighbor's door carried another ant before it, with which it passed all these obstructions, and deposited it safely in the holes at the other end of the route. The ants, travelling in the opposite direction, were all empty handed. This transportation continued for ten days, excepting during a rain. The larvæ and pupæ were carried last. After the migration was finished, the ants settled down to their regular summer work, and appeared only in small numbers in search of food.

In a shady corner under the door-step, the ants brought out the remains of the insects, whose juices they had eaten, and left them in a little heap, from which I took at one time three or four teaspoonfuls of skins and legs, some of them belonging to beetles as large as twenty ants.—J. H. EMERTON.

[Mr. E. Norton informs us that this is the *Formica fusca* Linn.—EDS.]

IS THE CROW A BIRD OF PREY?—In the summer of 1866, while out on a collecting trip with my friends, Messrs. Gill and Smith, about a mile from this city, we saw a crow (*Corvus Americanus* of Audubon) pounce down into a barnyard, after the manner of a hawk, on a brood of young chickens and carry one of them off. The act seemed strange to us at the time, for although we knew that a great part of this bird's food, at this season, consisted of the eggs and young of small birds, yet we had never heard of its capturing its prey in this manner. Can any of our ornithologists tell me whether this is a common practice with this bird or not?—CHAS. H. NAUMAN, *Lancaster, Pa.*

ALBINISM IN BIRDS.—You can add to the list of Albino birds (page [illegible]), a Reed-bird, shot near Philadelphia; the entire plumage is white, the bill and feet pale flesh-color. Also, a Robin; this is an instance of partial albinism, similar to that of the Blue Yellow-backed Warbler, described by Dr. E. Coues; that is, "the entire plumage is checkered or patched over with white, the normal colors showing in the spaces be-

tween the white." These specimens are in the possession of Joseph W. Drexel, Esq., of Philadelphia, who also has an example of a Ground Squirrel, or Fence-mouse, as it is commonly called, which is, with the exception of the stripes on the back, entirely white; the stripes are pale brownish or yellowish.

I trapped a snow-white specimen of the common rat, and also obtained another one from my friend, Mr. Charles Wood, of Philadelphia, but these, I suppose, are not uncommon. — HERMAN STRECKER.

MIGRATIONS OF BIRDS. — Do our migrating birds ordinarily follow the same route in their annual migrations? I think they do, uniformly, unless thrown out of their course by great stress of weather. In the fall of 1863, one morning I noticed a large flock of robins (*Turdus migratorius*) in my door yard, bathing in a kind of aquarium that I had constructed by excavating the earth and lining it with hydraulic cement. This tank is filled with water and swamp muck at the bottom, in which are growing the white Pond-lily (*Nymphæa odorata*), the leaves of which make a charming place for the birds to bathe and drink. Among the robins I noticed a fine Albino. He, with his *compagnons de voyage*, remained in my yard about half an hour, bathing, drinking, and eating the berries of the mountain-ash.

April came, and one morning my wife exclaimed, "Oh! what a large flock of robins!" I replied, "Look for my Albino," when my ears were greeted with "Yes, here he is, the same bird." He had some markings by which we knew him, two brown quills in his tail, and a few light-brown feathers on each shoulder. As before, they staid with me about half an hour, and passed on. Being sick, I had no expectation of living until fall, and requested my wife to watch for him the next autumn. How often I thought of that bird! shall I live to see him again? will he be alive? I knew he was a mark for the fowler and the naturalist. Fall came, and with it my Albino with a host of companions: they lingered as before, and passed on to the south. I had the same reflections about him and myself as before, made the same request to my wife to watch for him, and if he came again, and I was gone, to report to Professor Kirtland. Fall came, and with it my dear little Albino. Thus for five successive seasons this Albino came and went. Does not this pretty clearly settle the question? Whether he ever came again I do not know, for I sold my place and never heard of him again. — T. GARLICK, *Cleveland, O.*

THE UNICORN OF FABLE. — Mr. Groom-Napier observes that the discovery of the bones of a mammoth (1663) was the foundation of the fossil unicorn of Liebnitz, which the entire skeleton found in Siberia rendered a palpable error. The older naturalists were exceedingly fond of the subject of the unicorn, and the modern have made great efforts to identify the unicorn of the vulgate, which it is almost needless to say, points to an ideal animal, and not to the *rēēm*, a two-horned animal, translated unicorn in the Old Testament, and now generally considered to be the *Bos urus*, or wild bull of Palestine, now extinct. — *Land and Water.*

Siredon, a Larval Salamander.—At the last meeting of the Boston Society of Natural History (Sept. 16th), Professor O. C. Marsh, of Yale College, gave an account of some observations which he had recently made on the metamorphosis of *Siredon* into *Amblystoma*, two genera of tailed Batrachians, usually placed in distinct families. During an excursion to the Rocky Mountains in August last, Professor Marsh obtained in Lake Como, a small brackish sheet of water in Wyoming Territory, several specimens of *Siredon lichenoides* Baird, known in that region as the "fish with legs." On bringing them to New Haven, one of them soon showed indications of a change similar to that observed by Duméril, in the second generation of Mexican Axolotls, kept in the Museum of Natural History, in Paris.

The first phase noticed in the transformation, was the appearance of dark spots on the sides of the tail, and soon after the membrane along the back, and especially that below the tail, began to disappear. Next the external branchiæ, or gills, began to be absorbed, and the animal came more frequently to the surface of the water for air. As the change went on, the spots gradually extended over the rest of the body; the membrane of the back and tail entirely disappeared; the external branchiæ, as well as their interior arches, became absorbed, and the openings on the neck closed up. The body also diminished in size, the head changed in form, becoming more rounded above and more oval in outline, and the eyes became more convex and prominent. The opening of the mouth and the tongue both increased considerably in size, the teeth changed in position, and the animal made frequent attempts to leave the water, and at last escaped as a true *Amblystoma*, apparently identical with *A. mavortium* Baird. Subsequently several other specimens underwent the same metamorphosis, during which various experiments showed that the rapidity of the change was greatly affected by variations in light and temperature; the specimens most favored in these respects having passed through the entire transformation in about three weeks. Whether the species ever changes in Lake Como, which is about 7,000 feet above the sea, is uncertain, but that it breeds in the Siredon state, like the Axolotls from the table lands of Mexico, there can be little doubt. This interesting metamorphosis renders it extremely probable, that all Siredons are merely larval Salamanders; and it also suggests a doubt whether some, at least, of the other so-called Perennibranchiates may not be the undeveloped young of well-known species.

The Yellow-headed Blackbird (*Xanthocephalus icterocephalus* Baird).—We call this the Orange-head, knowing of no name more suitable. They arrive about the first of May, and disappear about the tenth of June. I do not think they breed in this country. They made themselves valuable to the farmers last spring in devouring the swarms of young grasshoppers. I had a lot of land on which the grasshoppers deposited their eggs by the million; as they began to hatch the yellow-heads found them out, and a flock of about two hundred attended about two acres daily, roving over

the entire lot as wild pigeons feed, the rear ones flying to the front as the insects were devoured. The farmers of Kansas are under great obligations to the little yellow-heads, or, as some call them, copperheads, for their services last summer. — W. J. McLaughlin, *Centralia, Kansas.*

[According to Professor Baird, this bird is essentially a prairie bird, and is generally distributed throughout Western America, from Texas, Illinois, Wisconsin, and North Red River, to California, south into Mexico, and it has also been found in Greenland. — Eds.]

Habits of the Common Red Fox. — While among the White Mountains in Stowe, Maine, a hunter told us that the fox comes out of its hiding-place at sunset to catch grasshoppers. At this time, and also at early dawn, they are hunted with the gun. In the winter the fox has been observed leaping vigorously upon the crust of the snow. The farmers say they do so to scare the field-mice out of their retreats beneath, in order to seize them. — Eds.

The Lobster. — It is now almost universally admitted, that, in order to meet the yearly increasing demand, not alone for oysters, but also for lobsters, crabs, etc., some other means of reproduction must be pursued besides leaving them simply to nature to "increase and multiply." This has been so well understood by the pisciculturists in France, that every exertion has been made to resuscitate the fisheries by increasing the produce by "artificial breeding." Many oyster-beds that, a few years since, owing to the "greed" both of the oyster-dredger and the consumer, were completely denuded of oysters, are now in a flourishing condition: and the artificial cultivation, not alone of oysters, but of lobsters, crabs, and other food-fishes (thanks to the genus of M. Coste, Hyacinthe Bœuf, M. le Docteur Sauvè, and other celebrated pisciculturists), has turned out a complete commercial success. The French Government also, alive to the welfare of the fisheries of the coast, has encouraged in every possible manner the maritime industry of the seaboard, and has given concessions of portions of the foreshore to men belonging to the naval reserve, in order to have them artificially cultivated for the production of oysters, lobsters, and other fish. These grants have been availed of to a large extent by the sailors in different parts of France, and have been a source of great profit to them. The Imperial Government has also caused several establishments to be constructed, such as those at "Concarneau," where lobsters and other crustacea are kept in tanks specially made for them, for the purpose of artificial propagation and rearing, whilst in other tanks, sea-fish, fit for food, are kept, so that the pisciculturist is enabled to study the habits of these various fishes, as well as their natural history. Were it possible to induce our Government to introduce similar establishments in this country, we should not now be bewailing the ignorance so much complained of at our recent sea-coast fishery enquiries in the House of Commons, when nearly all the witnesses had to confess they were completely ignorant of the habits, places of spawning, etc., of nearly all the varieties of fish frequenting our shores.

Monsieur Coste, in one of his writings, says: "It would be a great error to believe it were possible to attempt the education of any description of animal whatever, without knowing, at least in a superficial manner, something of its organization." We therefore purpose giving a short account of the natural history of the lobster, trusting to find the example set by the French Government at Concarneau, and followed on a small scale at Hayling, in the south of England, may be farther introduced into this country.

The lobster (*Astacus marinus* Fabr.*) belongs to the tribe of *Decapods*, and, according to La Blanchère, is easily recognized by its shell, which is of a brown, green, and blue shade, intermingled with red lines. The body terminates at the head with a tridented beak, with a double row of teeth on its upper jaw. It has two unequal-sized claws, one oval and powerful, the other more oblong, and small. The exterior antennæ are as long as the body, and are covered with red rings. The eyes are small and round, and of the same size as the peduncles. It has a large stomach and bent tail, terminated by five large swimming blades, serrated at the edges.

M. Coste, in his remarkable report to the minister of the French marine, has given the following description of the manner of the reproduction of the lobster, which will be found exceedingly interesting. "The lobster commences breeding in the month of October, and the pairing takes place sometimes as late as January. The couplings are rare at the opening of the season, but increase in frequency to the end of December, and but few take place in January. The female emits the eggs in about fifteen or twenty days after pairing. When they have reached the stage proper for their expulsion, the female applies the inner side of the tail against the plastrum, or shell immediately over the stomach, in such a manner as to form a cup or cavity, in which is to be found the openings of the oviducts placed exactly behind the third pair of legs. Consequently, when the eggs escape from the stomach, they fall into this natural cup or cavity as described above. They are expelled in successive jets to the number of 20,000 in a single day. The lobster, along with the eggs, emits at the same time a kind of adhesive liquid, which binds the egg one to the other, and attaches them all to the small feet under the tail, where they remain, in perfect shelter from all harm, until they are sufficiently ripe for final expulsion.

"In order to forward and force the regular incubation of the ova, the females have the power to give them more or less light, as they consider requisite, by closing or opening the folds of the tail. Sometimes the eggs are kept quite covered, and at other times they give them a kind of washing by moving the flanges of the tail in a peculiar manner. The incubation lasts six months, during which time the female takes such good care of the ova, that it is rare to find an injured embryo or barren egg. It is during the months of March, April, and May, that the actual birth of the young lobster takes place. When the females, in order to expel the em-

* Our species is the *Homarus Americanus*.

bryos, now ready to burst the shells of the eggs, extend their tails, make light oscillations with the fan and its appendages, so as to rid itself gradually of the young lobsters, which it succeeds in doing in a few days.

"The young lobster, as soon as born, swims away from its parent, rises to the surface of the water, and leaves the shores for the deep waters of the sea, where it passes the earliest days of its existence, in a vagabond state for a period of from thirty to forty days. During this time it undergoes four different changes of shell, but on the fourth, it loses its natatory organs, and is therefore no longer able to swim on the surface of the water, but falls to the bottom, where it has to remain for the future; according, however, to its increase of size, it gains courage to approach the shore, which it had left at its birth. The number of enemies which assail the young embryos in the deep sea is enormous, thousands of all kinds of fish, mollusks, and crustacea pursuing it continually to destroy it. The very changing of the shells causes great ravages at these periods, as the young lobsters have to undergo a crisis which appears to be a necessary condition to their rapid growth. In fact, every young lobster loses and remakes his crusty shell from eight to ten times the first year, five to seven the second, three to four the third, and from two to three the fourth year. However, after the fifth year, the change is only annual, for the reason that were the changes more frequent, the shell would not last long enough to protect the ova adhering to the shell of the female during the six months of incubation. The lobster increases rapidly in size until the second year, and goes on increasing more gradually until the fifth, when it begins to reproduce, and from this period the growth is still more gradual."—R. K. Wood, *in Land and Water, London.*

GEOLOGY.

What is a Geode?—The term *geode* is applied by geological writers to two distinct conditions and character of rocks, in so promiscuous a manner that the reader, without specimens, has no means by which to determine, with any degree of certainty, what it is of which the writer is treating. Let me illustrate by numbered examples:

No. 1. In many rocks there are irregular cavities, of moderate size, whose inner walls are studded with mineral crystals. The walls of these cavities are of the same material as the general mass of the rock in which they occur, and in no way distinguishable from it, the cavity being a mere opening in the general mass of the foundation.

No. 2. Rounded masses of quartz, often Chalcedonic, occurring enclosed in limestone, etc., but as foreign in character, from the mineral enclosing them, as raisins are to the mass of a pudding by which these have been surrounded in the process of cookery. When destructive weathering of the rock containing these takes place, these balls fall out into the soil, where they remain wholly unattacked by the elements.

These silicious nodules vary in size from that of an apple to that of

a human head. They usually enclose a cavity, the walls of which are studded with crystals of one, and often of several minerals, frequently presenting great beauty of appearance. The former of these (No. 1) is abundant in the Niagara limestone of the New York State Survey; while the latter (No. 2) occurs in profusion in the limestones of Indiana, Missouri, and other portions of the Mississippi Valley.

The two objects above described, though so utterly unlike, are without any distinction called *geodes* by geological writers. And why?

That the two objects, so essentially different, should be known by distinctive names seems wholly self-evident. The present usage of writers in coupling both under one and the same name, as they constantly do, is productive of extreme confusion, while the practice is not justified by any apparent necessity whatever. — R. W. Haskins, *Buffalo, N. Y.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science. — Natural History Section. *Chicago, Ill., August* 5–12, 1868. Gen. G. K. Warren presented a paper "On certain Physical Features of the Upper Mississippi River." He had been detailed to survey the Upper Mississippi, Minnesota, and Wisconsin rivers, with a view to improving the navigation and constructing bridges which should afford the least obstruction to navigation practicable; in doing this he has reached results, which, besides being important to the objects for which they had been sought, were believed to be of general scientific interest. He had been early impressed by the immense excavations made in the Silurian rocks through which these rivers now flow. This great excavation above the junction of the Minnesota and Mississippi rivers, is occupied, not by the Mississippi river but by the Minnesota river. The bed of this latter, however, for about one hundred and ten miles below Big Stone lake, is partially granitic. Big Stone lake occupies thirty miles of this great excavation, and Lac Travers about twenty. The two lakes are separated by a strip of low land, but a few feet above their level, and about nine hundred and eighty feet above the ocean level. This is a deposit made by the infant Minnesota river as it enters this great excavation, and during heavy rains the streams send their waters to Hudson Bay as well as the Gulf of Mexico. The great excavated valley of which we have been speaking, is at this point about a mile wide, and the bluffs, or sides, composed of bowlders and gravel, are about one hundred and fifty feet high. Were one inclined to believe that the present streams in a long period of time would be sufficient to excavate the valley of the Mississippi, he must admit their insufficiency here. In fact these feeble streams, so far from having made this great excavation, are doing their best to fill it up.

Northward from Lac Travers commences a vast lake basin extending continuously to the north end of Lake Winnipeg, including this lake, Lake Winnipigoos and Lake Manitoba. The greater part of this ancient lake-bed is now dry, leaving a well-defined beach to mark its former extent. Although the Red river of the north flows north along the lowest line of this bed, he concluded that the waters of this basin once flowed southward, through the Minnesota river, into the Mississippi.

The present level of Lake Winnipeg, according to Mr. Hines, is six hundred and fifty feet above the ocean. To cause the waters to flow southward again, with the present levels of the land existing, would require the lake to be raised three hundred and thirty feet. It is obvious this could not be done while the Nelson river outlet existed. There is no good description of this outlet, as it is never used for a line of communication; it abounds in rapids and falls, which seem to show its recent origin. If we suppose the ice of the glacial period to have closed this, it would have given the lake the whole extent of the basin, and caused its discharge southward; but this will not account for all the phenomena observed.

A more satisfactory explanation of a change of outlet from a southern to a northern one, is to attribute it to a northern depression of the basin; for it is found that Lake Michigan formerly had a southern outlet through the Illinois river, and Lake Winnebago also had a much greater extent and a southern outlet. The shores of all the lakes show the water to be receding from their southern ends and encroaching upon the northern. This northern depression is known to be going on along the Atlantic coast from New Jersey to Greenland.

Gen. Warren said that further consideration had shown him that all the waters of Winnipeg basin, even if they had continued to flow southward could not have excavated the passage-way now occupied by the Minnesota and Mississippi rivers, and that we must go farther back in time to reach a sufficient cause. In doing this we must first consider the character of the rivers which existed in this region previous to the glacial epoch. During the Cretaceous period we know that an ocean extended from the present Gulf of Mexico to the Arctic Ocean, covering a large portion of the space between the Missouri and Rocky Mountains. At that time the upper country through which the Mississippi now flows was dry land, and its slopes must have sent its waters westward to the Cretaceous ocean. As the continent rose this Cretaceous ocean disappeared, and the Tertiary period began with great fresh-water lakes along the base of the Rocky Mountains; into these lakes the waters of the Upper Mississippi region continued to drain westward. The gradual south-western elevation of the continent throughout the Tertiary period is distinctly proved by the deposits of these Tertiary lakes. The earlier deposits were of least area, and as they become more recent they expand north-eastward, and this continued apparently to the time preceding the glacial epoch. This elevation at the south-west seems to have been in progress from the earliest

geological epoch; every contemporaneous formation being found in the mountain regions of the south-west higher than to the north-east.

Preceding the glacial period, then, all the water-courses of the Upper Mississippi region were westward, and not southward as now. Not only the slope of the land, but the great folds of the Silurian strata compelled the water to take this course. Over a great deal of the region thus drained, no rocks more recent than the Silurian are found, so that it must have been dry land since the Silurian period. In the immense ages succeeding, this dry land was exposed to all the atmospheric influences, and we can conceive how it must have been cut up by ravines and valleys encroaching on each other in endless confusion, as we now see in the bad lands of Nebraska. Even the hard azoic rocks forming the dry land of the Silurian period must have exhibited the most stupendous atmospheric erosions. These preglacial erosions can still be distinguished from those more recent. When, then, the glaciers came it would seem that their work was easy, and they have planed down the whole region, removing Silurian slata several hundred feet in thickness, over hundreds of miles. The whole Upper Mississippi region was the scene of the drift action, and the valleys of preëxisting rivers were filled up and mostly buried out of sight. The existence of a distinct glacial moraine at Warsaw, on the Mississippi, shows that the glaciers were at least that far south.

He had determined the south-western limit of the glacial or drift action to be the Missouri river, from about the 48th down to the 43d parallel of latitude. The modified drift forms the grand Coteau du Missouri, lying on its east bank, and this material extends thence north-eastward almost continuously. From the Missouri river to the Rocky Mountains, a distance varying from three hundred to five hundred miles, no drift is found except that due to local glaciers of the mountains, which, in some places, extended for fifty miles east of their bases. The existence of this space between the Missouri river and the Rocky Mountains shows that the form of the continent and seas in the glacial time were such as to produce in the climate relations similar to what now exist: namely, that the mountain region to the west intercepted the moisture as now from that direction, and that the supply for the Mississippi valley came from the south as at present, moved with the winds in a north-easterly direction as now, and left an arid region such as we now have along the plains east of the mountains. Since low temperature and moisture combined are required to produce a glacier, it follows that either high temperature or aridity would arrest their formation. If high temperature limited them southward and aridity westward, the limiting line would have taken a north-west and south-east direction, somewhat as the summer isothermal line does now. The motion of the glacial mass must have been along the line of least resistance, and towards this limiting line, and the glacial scratches in the Upper Mississippi region show that the motion was south-west. There, then, on that limit a river must have formed, to carry away the melting

water from the glacier, and this limit was the Missouri river, and that was the river formed thereby. It cut along this glacial limit because all the streams west of it came from the mountains toward it, and there their old course was terminated. We see what lakes must periodically have formed here, what great barriers must have been formed and burst one after another, and what deluges the lower valley must have experienced. When the glaciers began to retire to the north-east, as long as the general slope of the continent was towards the glacial mass, successive rivers were marked out by it along its western face, and all have a parallelism, and are close to each other, and have short tributaries or parallel branches if any. They are, besides minor streams, the James river, the Big Sioux river, the Des Moines river, the Iowa and Cedar rivers, and finally the Minnesota and Mississippi rivers, the last of the parallel series. After the lowest line of the continental valley was passed, the glacier would begin to retire in such manner that the melting water would run directly from it, and such we see is the direction of all the tributaries of the Mississippi on the east side. This direction corresponds with that of the preglacial rivers, and it is probable that some of them, such as the St. Croix river, Chippeway river, Wisconsin river, etc., washed out and regained their old beds, for so their appearance would indicate.

The bend of the great valley along the Minnesota river, between Mankato and St. Paul, being at right angles to the main course of all these parallel glacial rivers, would seem to disprove the view that the formation of this river took place along the glacial margin. But it probably is the bed of one of these preglacial rivers, as it lies in the proper fold of the Silurian rocks and seems to have been formed in an ancient valley. From St. Paul southward, however, the present course of the Mississippi is cut square across this fold in the rocks, and the glacial action is the only explanation of it.

The manner in which the glacial action produced these valleys was not by abrading the strata with the grinding power of rocks embedded in the ice, but after the manner in which a block of marble is sawed. The glacier supplied an immense power in the melting water, and into this water it was constantly dropping sharp rocks and sand.

The waters issuing from a lake have little abrading power, for they have comparatively little rubbing material to operate with. Thus it was that the waters issuing at the old southern outlet of Lake Winnipeg could make no impression on the granitic bed of the Minnesota. Had this material been soft like the Silurian rocks lower down in its course, or like the Tertiary and Cretaceous rocks through which the Missouri has cut its way, then this part of the valley would have been worn away in the same manner, and we should have the drainage of all the Winnipeg basin still to the southward. A cut of four hundred feet at Big Stone lake would have drained it, nor would the banks then have been as high as those of the Missouri, at the Bijou hills, which are eight hundred feet above the water of the river. The slope of the Missouri is more than double that

of the Mississippi, and hence the water of the Missouri river is several hundred feet higher than that of the Mississippi, at points in the same latitude in their upper courses. An examination of the bluffs along the Mississippi shows that the space between them is on the whole quite uniform in width, gradually increasing downward, being about a mile at Big Stone lake, and reaching six to ten miles at Commerce; below this the space widens out to from forty to sixty miles. Sometimes the river, as at the "Grand Tower" and at "Le-montagne-qui-trempe ã-l'eau," and several other places, is found flowing between bluffs not even a mile apart; but the bluffs on one side or the other are always found to be a detached mass, and the main valley exists there too.

Two remarkable exceptions to this occur at the rapids,—one at Keokuk, the other at Rock Island. Without lengthening this paper to such an extent as would be necessary to go fully into an explanation of these exceptions, he stated that after being long puzzled by them, he discovered that the whole valley had been covered with an extension of the Gulf since the glacial period as high up as Savannah or Dubuque; that the silt brought in by the Des Moines river in the one case, and by the Iowa and Rock rivers in the other during this period, entirely filled up the bed cut out by the great glacial river, and that when the land rose again, the Mississippi could not at these points regain its old bed. So it had to cut a new one, and this it has not yet completed. The space between the bluffs at these two places has the width the present river requires, and it is so nowhere else in its whole course.

It might be thought that these investigations do not affect the question of improving the navigation of the rivers or bridging them. In removing obstructions we have two kinds to deal with, such as arise from causes not now operating, and which once removed would not recur, and those from causes that are now operating and which must be constantly recurring unless the cause itself is removed. The discussion given forms the bases of a proper discrimination of these causes. The question of bridging the Mississippi keeps in view largely the action of the stream and the character of its bed. The usual argument that the scouring action that has been in operation may take place again, must not be applied here till we can separate the observed effects of such agencies as here treated of from those now at work. Instead of probing with an iron rod every inch of the bed before we can determine the practical depth at which firm rock may be reached, we have here established general conclusions, which settle the question for all points at once. This is illustrated by referring to what took place all along the Mississippi, when the Winnipeg basin ceased to discharge its waters southward. The former river, which bore along all the sediment brought by its tributaries, was gone. Everywhere along its course these tributaries continued to deposit at their mouths the sand and heavy material as before, and there it accumulated till a lake gradually grew above each point of junction. The waters of each lake gradually spread this material down the valley, and encroached upon

the lake below it, as a delta advances into any body of water into which a stream flows. These lakes in most cases were thus gradually filled up, leaving countless delta islands in their place, but Lake Pepin still exists made by the sands deposited by the Chippeway. Lac qui Parle and Big Stone lake, on the Minnesota river, are of the same kind. The depth of water in these lakes is still fifty to seventy feet or more, so that having thus accounted for their origin, we have in their depth the least measure of the depth of sand above and below them. There is no need, when we know how this river passage was made, to sound in order to get the depth of the sand. We know the foundation everything must have that crosses the valley of the Mississippi. The exceptional cases at the rapids I have explained.

So far what is said is mainly in the way of a demonstration to account for "Certain Physical Features of the Upper Mississippi river." The grandeur of the subject he had tried to keep from influencing his observation and deductions therefrom. But part of the facts by which the conclusions are reached are here given, nor are all of the inferences drawn which the facts presented will warrant.

He hardly knew how much of what he had said is derived from others. He had consulted some of the most distinguished geologists on the general subject. He was particularly indebted to Mr. James E. Mills of New York, whose investigations of the gradual northern depression going on along the Atlantic coast, suggested to him to account for the change of outlet of Lake Winnipeg in the manner above. He believed his observations in themselves demonstrate this depression to be going on along the great central valley, so that we are authorized to conclude that it probably embraces the whole continent. This must affect all the rivers and all the lakes, bays and oceans around us, and so far as his observation and reading extend, they all give the same proofs of it. It is, however, a field for many observers, and he ventured this incomplete showing, so that others who have the opportunity, and deem it worthy of their efforts, may help along the investigation.

KENT SCIENTIFIC INSTITUTE. *Grand Rapids, Mich., Sept.* 11, 1868.— Mr. A. O. Currier presented a paper for publication, entitled "A List of the Shell-bearing Mollusks of Michigan, particularly of Kent and adjoining counties." The list contains all the species heretofore described, and several new to science, of which descriptions exist only in the manuscript of Mr. Currier.

Mr. George W. Smith gave an account of a series of examinations made of a group of ancient mounds situated four miles below the city, on low ground adjoining the Grand Rapid river. The group consists of thirteen mounds, and is placed upon an area 700 by 400 feet. The mounds vary in height from five feet to over twenty-five, and in diameter from twelve to over sixty feet. They appear to have been constructed on no decided plan, but run promiscuously in a direction nearly east and west. Their character, or that of their builders, are unknown to the present race of

Indians who have inhabited the locality for many generations. Trees three and four feet in diameter lie in a state of extreme decay on many of the mounds, while hardwood trees, quite as large, grow luxuriantly on nearly all of them. Several of the mounds have been explored quite thoroughly. Two vases of pottery, copper and stone implements, bone-needles, and a piece of wicker work, very unique, and probably intended for a basket, were found. The latter was too far gone to be saved. Pieces of flint were also seen strewed in one mound. The vases of pottery rested on a hard loam foundation, a few feet square, and in both cases on a level with the ground. Layers of ashes and burned earth appeared frequently in the excavations. The builders, probably, belonged to the race whose monuments are so numerous farther south.

ANSWERS TO CORRESPONDENTS.

P. G. M., New York.—(1) We cannot give the number of known species of Kingfishers in the world. Mr. Cassin, in his catalogue of the specimens of the family contained in the large ornithological collection of the museum of the Philadelphia Academy of Natural Sciences, published in 1852, gives ninety-one species from various parts of the world. (2) We do not know what is meant by Kinghunters. (3) It is well, in order to avoid being led into error, to question much that is given in works of a popular character, unless the statements are taken from a well-known authority on the subject, and even then you must remember that the most noted naturalists have sometimes made statements which farther research has shown not to be true. In general, the work you refer to is as reliable as most compilations.

J. C. C., Notre Dame, Ind.—We have printed labels of the Family and Generic names of the Hymenoptera and Lepidoptera, and are gradually printing those of the other orders of Insects. We also have printed labels of the different States of the Union, and localities in Mexico, Central America, etc., in small type, and abbreviated for pinning under insects. Also blank labels, with a red border, for filling out with a pen. We shall advertise these as soon as we have some others printed, but in the meanwhile we could furnish any of them at a fair price.

E. O., Yellow Springs, O.—We send the names of the beetles remaining unnamed from your collection: 1, *Nebria pallipes* Say; 2, *Chlænius tricolor* Say; 4, *Dicælus purpuratus* Bon.; 5, *Bembidium chalceum* Dej.; 6, *Dicælus teter* Say; 7, *D. sculptilis* Say; 8, *Anomoglossus emarginatus* Say; 9, *Stenolophus ochropezus* Say; 10, *Chlænius rufipes* Dej.; 11, *Pterostichus* (Pœcilus) *lucublandus* Say; 12, *Platynus sinuatus* Dej.; 13, *Clivina bipustulata* Dej.; 14, *Pterostichus* (Omaseus) *mutus* Say; 15, *Bradycellus rulpecula* Say; 16, *Pterostichus* (Pœcilus) *occidentalis* Dej.; 17, *Helluomorpha laticornis* Dej.; 18, *Anisodactylus nigerrimus* Dej.; 19, *Dacne heros*; 21, *Staphylinus maculosus* Grav.; 22, *S. mysticus* Erich.?; 23, *S. cinnamopterus* Grav.; 24, *Creophilus villosus* Grav.

E. P. A., Milwaukee, Wis.—1, *Geopinus incrassatus* Dej.; 2, *Chlænius sericeus* Forst.; 3, *Pœcilus*, species?; 4, *Calosoma calidum* Fabr.; 6, *Arhopalus fulminans* Fabr.; 7, *Elaphidion mucronatum* Say; 8, *Clytus campestris* Oliv.; 9, *Clytus marginicollis* Laporte; 10, *Physocnemum brevilineum* Say; 11, *Hylobius pales* Herbst; 12, *Sphenophorus* sp.? 13, *Sphenophorus cinereus* Say?. 14, *Balaninus rectus* Say; 15, *Aphodius fimetarius* Linn.; 16, *Dichelonycha* sp.?; 17, *Eumolpus auratus*; 18, *Doryphora* 10-*lineata*; 19, 20, *Mysia* 15-*punctata* Oliv., varieties; 21, *Disonycha pluriligata* Lec.; 23, *Coccinella bipunctata* Linn.; 24, *Phyllobrothica*.

We would like more specimens of those numbered 5, 6, 7, 10, 15, 16, 22, by E. O., and 16, 12, 13, by E. P. A.

J. H., Albany, Oregon.—The insects were duly received. Any specimens from Oregon are very desirable. Preserve all beetles, bugs, and Hymenoptera (bees, wasps, ants, etc.), in alcohol or whiskey. Place butterflies and moths in folded papers. The rock specimen was volcanic tufa. We will answer your enquiries, regarding the plants, in our next number.

L. M., Norwich, Conn.—Harris's Catalogue of North American Sphinges is in Silliman's American Journal of Science and Arts, Vol. 36, p. 282. 1839.

A. P. Hudson, Ohio.—Mr. W. V. Andrews has changed his address to West Hoboken, N. J. He expects to have some eggs of the *Yama-mai* moth next spring.

T. L. M., New York.—The fly-parasite of Orgyia was a species of *Tachina*, which, like Ichneumon, is parasitic on caterpillars. The species of this and the allied genera are internal parasites.

J. M., Belleville, Canada.—We shall print your notes in our next number. Brief botanical notes would be welcome to the NATURALIST. We would print the most useful.

A. W., Boston.—The third number of the GUIDE TO THE STUDY OF INSECTS was delayed until October 10th, owing to the failure of the party doing the electrotyping. Number four will be issued as early in November as practicable.

BOOKS RECEIVED.

A Treatise on the Artificial Propagation of certain kinds of Fish. By T. Garlick. M. D. Cleveland, 1857. 8vo.

Extra Digits. By Burt G. Wilder. Boston, 1868. 8vo, pp. 20.

A Conspectus of Botanical Terms which are used in the Description of Flowering Plants. Bowdoin College, 1868. 16mo, pp. 12.

Journal of Travel and Natural History. Vol. 1, No. 4, 1868.

The Tim Bunker Papers. New York, Orange Judd & Co. 1868. 12mo. With illustrations by Hoppin.

Archiv der Anthropologie. Edited by A. Ecker and L. Lindenschmidt, Braunschweig, Prussia. Vols. 1; 2, parts 1–3. 1866–'8. 4to.

A System of Mineralogy. Descriptive Mineralogy, comprising the most recent discoveries. By J. D. Dana, aided by G. J. Brush. Fifth edition. Rewritten and enlarged, and illustrated with upwards of 600 wood-cuts. New York, 1868.

Constitution and By-Laws of the Entomological Society of Canada. 8vo, pp. 4.

The Canadian Entomologist. Vol. 1, No. 2. September, 1868.

The American Entomologist. October, 1868. St. Louis, Mo. 8vo.

How Crops Grow; a Treatise on the Chemical Composition, Structure, and Life of the Plant, for all Students of Agriculture. With numerous illustrations and tables of analysis. By S. W. Johnson. New York, Orange Judd & Co. 1868. 12mo.

Journal for the Popular Diffusion of Natural Science. Vol. 5, No. 3, 1868. Copenhagen.

Orographic Geology; or, the Origin and Structure of Mountains. A Review. By G. L. Vose. Boston, Lee & Shepard. 1866. 8vo.

Cosmos. September 12, 19, 26. Paris.

The Field. August 21, 29; September 5, 12, 19, 26. London.

American Bee Journal. October. Washington, D. C.

Chemical News. August, September, October. New York.

Science-Gossip. September. London.

Annual Report of the State Mineralogist of the State of Nevada, for 1866. Carson City, 1867. 8vo.

Natural History of Birds. Lectures on Ornithology, in ten parts. By Grace Anna Lewis. Part I, 1868. Philadelphia, J. A. Bancroft & Co. 12mo, pp. 32.

THE

AMERICAN NATURALIST.

Vol. II.—DECEMBER, 1868.—No. 10.

BIRD'S-EYE VIEWS.

BY DR. ELLIOTT COUES, U. S. A.

BIRDS alone, of all animate beings, may be truly said to "fall asleep" in death. When the silver cord of a bird's life is loosened, the "windows of the soul" are gently closed by unseen hands, that the mysterious rites attending the divorce of the spirit from the body may not be profaned by prying looks. With us, the first office rendered by sorrowing friends to one departed, is to close the eyes, to hide from view the mockery of life that looks out from between motionless lids. And when any mammal expires, the eyes remain wide open. With all, the stony stare of the glazed ball is the sign of dissolution. Only birds close their eyes in dying.

This is one of the differences between birds and mammals. Beautiful and wonderful as birds are in this respect, which comes to the reflective mind fraught with significance, we shall find them scarcely less beautiful and wonderful even as regards the material, physical structure of their eyes. Let us look into a bird's eye. Though the flash and glow of life be gone, and only dead tissues left, we shall still find more than we can fully comprehend, and everything that we see will excite interest and admiration.

Entered according to Act of Congress, in the year 1868, by the PEABODY ACADEMY OF SCIENCE, in the Clerk's Office of the District Court of the District of Massachusetts.

To commence by saying that all birds have eyes, might appear at first sight to be superfluous. Yet this statement expresses one of the characters of the class *Aves;* for it is not applicable, without some qualification, to any other class of Vertebrates. Some representatives of each of the other classes either have no eyes at all or else very rudimentary ones. There are blind fishes and blind reptiles; and there are mammals at least "as blind as a mole." Among birds, the "wingless" species of New Zealand (*Apteryx*) are said to have the smallest eyes of all, and also to want one of the most characteristic structures of the avian eye-type,—the marsupium, a peculiar organ inside the eye, of which we shall learn something before we have finished our "Views."

We will examine first the accessory structures of a bird's eye,—those that surround and defend it, produce its movements, and keep it in working order; and then we will look at the more exquisite mechanism within.

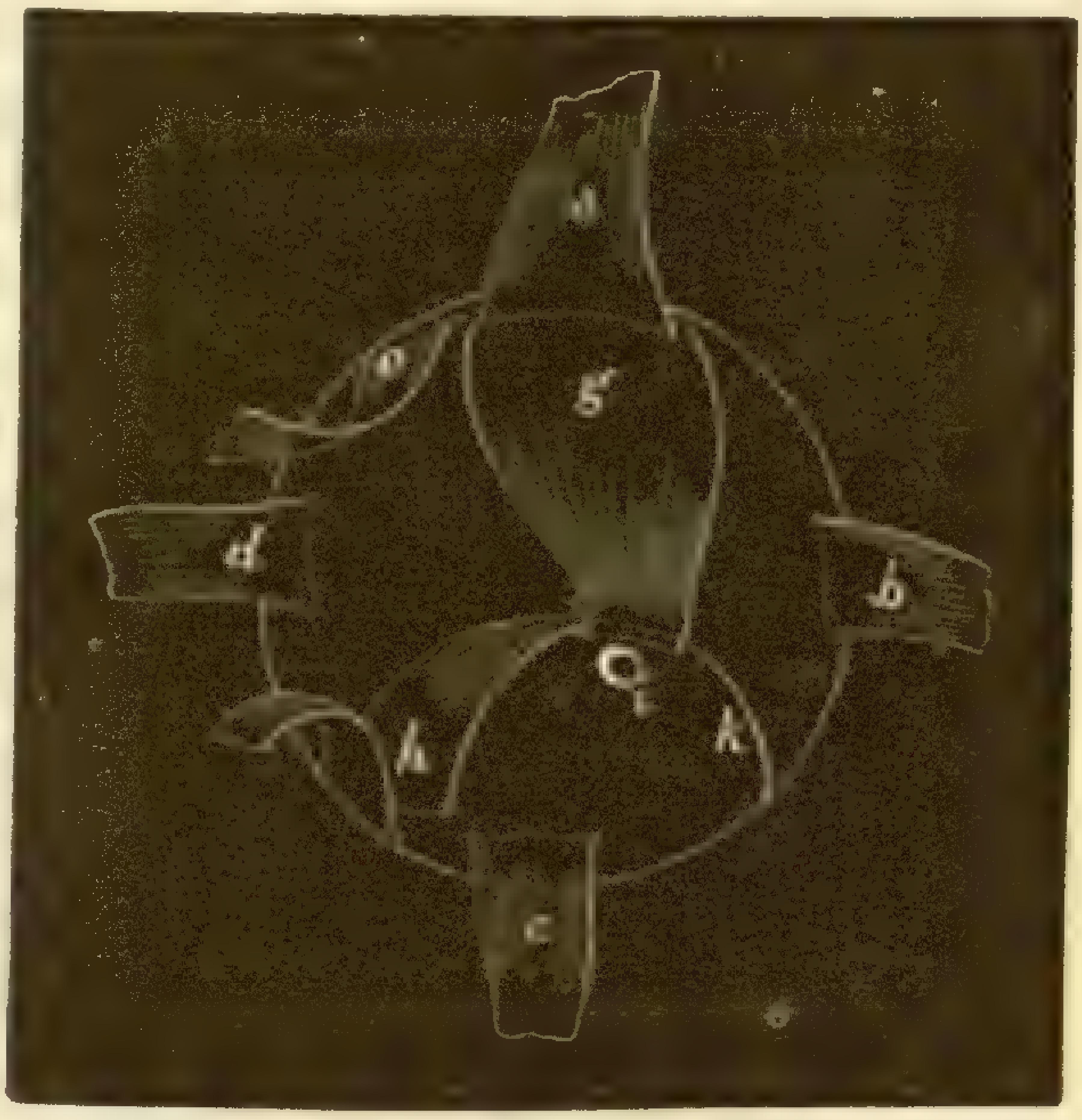
If we hold a dying bird in our hands, we observe that just as the last convulsive shiver agitates its frame, the eyes close by the uprising of the lower lid. In the primitive theatres of classic days, the curtain was lowered from the top to disclose the stage, and drawn up when the act was over; now these movements are reversed. Birds follow the classic usage, when the curtain rises upon the last scene of their life. Here at the outset is one difference between the eye of a bird and that of a mammal; and differences will multiply as we proceed.

The movements of the upper lid, in almost all birds, are much more restricted than those of the lower. There are few exceptions to this rule, and these chiefly furnished by the nocturnal raptores (*Owls, Strigidæ*), and certain fissirostres (*Caprimulgidæ*, e. g., Whippoorwill, Night-hawk). Both lids are composed of common skin externally, a membrane internally (the palpebral part of the conjunctiva, to be noticed presently), with a layer of fibrous tissue interposed for greater strength. Besides these tissues, the lower lid

has also a smooth oval plate of cartilage to stiffen it. The upper one is raised by a very small muscle, called *levator palpebræ superioris*, arising from the rim of the bony orbit, and running to the edge of the lid. There is no special lowering muscle; it is depressed by the action of part of another muscle, the *orbicularis oculi*, that nearly surrounds the eye, the chief office of which is to pull up the lower lid. The latter has a small distinct muscle for its depression.

A bird's eye, when wide open, appears almost perfectly circular; there are no well marked corners or angles (*canthi*) in front or behind, as in man and most mammals. Birds have no true eyelashes, but some kinds have two series of short modified feathers along the edges of the eyelids, that may be considered to correspond to the hairs found in this situation in mammalia.

Fig. 1.*



Now let us separate the lids and look at the eye. Not yet! "In the twinkling of an eye" a third lid is disclosed inside the other two, throwing a veil over the ball. This third inner eyelid is the nictitating membrane (*membrana nictitans*), a very curious structure, both in its movements and functions. It is a very thin, delicate, elastic membrane, transparent, or nearly so, of a delicate pearly-white color. While the other two lids move vertically, and have a hori-

*Fig. 1, right eyeball, seen from behind, showing the muscles. *a*, rectus superior; *b*, rectus externus; *c*, rectus inferior; *d*, rectus internus; *e*, obliquus superior; *f*, obliquus inferior; *g*, quadratus; *h*, pyramidalis, with its tendon, *k*, passing through pulley of quadratus (as shown by dotted line) to keep it from pressing on optic nerve *i*, then running to the edge of the ball, around which it passes.

zontal commissure, this one sweeps horizontally, or a little obliquely across the front of the ball, from the side next the beak to the outer one. When not in action, it lies curled up in the lower anterior corner of the orbit: when wanted for use it is pulled over the eye by the action of two muscles that grow on the back of the ball. The mechanism of its movements—the most perfect and ingenious that could be imagined—may be clearly understood with the help of the figure on the preceding page, which represents the back of the right eyeball, with all its muscles. Two of these act upon the nictitating membrane alone; *g* is the *quadratus* muscle, so called from its somewhat squarish shape, arising at the upper margin of the ball, and extending down on the ball to the optic nerve, *i*, where it ends in a broad flat transverse tendon, not attached to anything, but perforated so as to form a sheath or loop; *h* is the *pyramidalis* muscle, also so-called from its shape, tapering into a very long thread-like tendon, *k*, that first runs through the pulley-like sheath in the tendon of the quadratus, and then curves downwards and backwards over the ball, to the margin of the latter. It winds around, gets in front of the ball, and goes to be inserted into the lower corner of the nictitating membrane. If this slender tendon went straight along to the margin of the ball, and across the front, it would be right in the line of vision when the nictitating membrane, retiring to its corner, pulled it after. If it went directly under the ball to get to the front, it would not have the right direction to draw the membrane straight across the eye. So it must wind around the optic nerve. But now it would press upon, and interfere with the all-important functions of the nerve, if there were no provision for keeping it away from the nerve when the pyramidalis exerts its force of traction. Here the quadrate muscle comes into beautiful action; it always contracts simultaneously with the pyramidal, and carries the tendon of the latter up out of the way of the nerve. Such is the ingenious, concerted action, of these two muscles.

which, though contracting in opposite directions, and mutually antagonistic as far as the nerve is concerned, eventually exert their force in the same direction, and work harmoniously for a common purpose. When the tendon of the pyramidalis is loosened by relaxation of the two muscles, the nictitating membrane is set free, and returns to its hiding-place by virtue of its own elasticity, just as the curtain of a coach window, after being forcibly drawn down, rolls itself up again when the lever that sets a spring in action is moved.

We understand the mechanism of the nictitating membrane better than we do its use. Birds can wink with this one eyelid alone, as might be expected from its name, wherein they beat mammals, that cannot wink without moving both lids. If we menace a bird's eye with the finger, we see that the nictitating is the first of the lids to rush to its defence. But the membrane is believed to be chiefly subservient to regulating the amount of light to be admitted to the eye. The eagle is, probably, able to soar aloft directly in the sun's rays, by drawing this covering over its eyes. Owls habitually sit, in the daytime, with drawn curtains to shut out the glare of light. It is also quite possible that many, or most birds that are rapid flyers, make great use of this membrane in guarding against various dangers to which the eye would be exposed in their dashing career. A screen is placed before the eye, which, while not preventing sight, as closure of the outer lids would, opposes the entrance of any particles of matter.

Three lids of the casket that holds the gem have been raised, and yet there is still another covering of the jewel within. A very delicate filmy membrane, not very apparent on ordinary inspection, is laid over the front of the ball, from around which it is reflected over on to the inside of the two outer lids. This is the *conjunctiva*, so-called because it joins the lids to the ball. It is a highly vascular tissue, with numerous tortuous blood-vessels ramifying all through it.

When these vessels become engorged with blood, as occurs in congestion or inflammation of the conjunctiva, they are very distinctly seen, and we have the state of things that is called "blood-shot."

Before examining the eyeball, which at length we have reached, let us glance at some accessory structures that are found lying with it in the socket. Properly speaking, birds cannot be said to cry; their features are immobile, and cannot wear an expression of grief; but they can shed tears. The tears are elaborated by two small glands that lie inside the eyelids, one in each corner. These are both "lachrymal" glands; but the one that lies in the corner next the beak is called the "Harderian gland." It is smaller than the other, nodulated in shape, and deeply seated inside the nictitating membrane, upon which it pours out a viscid or glairy secretion through a small opening, the mouth of a short duct that receives branches from all parts of the gland. The nictitating membrane requires constant oiling to work easily; the Harderian gland is an oil-can that can both make the oil and apply it when needed. The other, more truly a lachrymal, or "tear" gland, pours its secretion into the posterior or outer corner of the eye, near the juncture of the two outer lids, which are thus kept soft and moist on the inside. Tears, in the concrete, viewed anatomically or physiologically, are very different things from tears regarded abstractly as to their æsthetic relations; at any rate, they subserve a much more useful and sensible purpose. The "lachrymal duct," which is neither more or less than a drainage-tube for the eye, to carry off superabundant tears, or tears that have fulfilled their function and are worn out, commences by two little openings in the anterior lower corner of the eye, and runs into the nose, which is thus made a cesspool to receive the refuse waters of the eye. There is, beside the two above-mentioned, a third gland about the eye, very large and conspicuous in some birds, as the loons, albatrosses, and other swimmers, in which it is lodged in a

deep semilunar groove in the roof of the bony orbit. But it does not belong to the eye at all, and seems to be stowed there for want of room elsewhere. Its long duct runs along the top of the orbit into the nose, pouring out a secretion that lubricates the mucous membrane (*pituitary* membrane) of the nasal passages.

The lachrymal glands keep the eye's face clean, and relate chiefly, if not wholly, to the movements of the eyelid. The eyeball itself rolls about by the indirect aid of a different tissue—the *areolar*, or *cellular*, as it is indifferently called,—the interstices of which are filled with fat. Ordinarily, the socket of an eye is much too large for the ball, and of a conical, instead of globular shape, so that the ball can no more fit or fill it, than can a marble dropped into a candle extinguisher. A bird's eyeball is more nearly fitted to its socket than that of most mammals; still, it rests wholly or in great part upon a bed of fat. This soft, yielding, elastic substance gently presses the eye forwards, and holds it there in place, accurately adapted to the lids, while at the same time it allows the ball to rotate any way upon its own axis, and also keeps it greased. We have a great deal of fat in our own eye-sockets in health. The reason that people's eyes are sunken or "hollow" after a long illness, is because part of it is wasted away. While there is so much fat all around the eyeball, there is not a particle in the eye itself; this comparatively clumsy and stupid material would be like a bull in a china-shop in such a nervous quick-witted structure.

Ducks are said to roll their eyes up in a thunder-storm, and very likely they do, since all birds move their eyes about more or less when they are not asleep. But the amount and degree of motion that a bird's eye is capable of is small in comparison with that enjoyed by most mammals' eyes. This results partly from the shape of the orbit, and partly from the shape of the ball itself, which last is very singular, as we shall see in the sequel. Nevertheless, there are as many

muscles in a bird's eye as in a mammal's. They are six in number; whereof four are called "straight" muscles (*recti*) and two "oblique" (*obliqui*); though for the matter of that, they are all of them straight enough. The terms refer to their line of traction. The four recti all arise near each other, at the back of the bony orbit, around the hole (*foramen opticum*) that lets the optic nerve in from the brain; and go to be inserted into the eyeball at four nearly equidistant points around its margin. One (*musculus rectus superior*, *a*, in Fig. 1) goes to the top; another (*m. r. inferior*, *c*) to the bottom, antagonizing the first; the other two (*mm. r. internus*, *d*, *and externus*, *b*) respectively to the front and rear (or to what would be the inner and outer sides, if a bird's eye were directed forwards like ours), and also antagonize each other. The two oblique muscles arise farther forward in the bony orbit, near each other, and then diverge, one (*m. obliquus superior*, *e*) going obliquely upward, the other (*m. o. inferior*, *f*), obliquely downward: they are inserted near the margin of the globe, close by the insertions, respectively, of the upper and under recti muscles. Their action appears to be very limited: the most notable thing about them is that the superior one goes straight from its origin to its insertion, whereas in mammals this muscle changes its direction almost at a right angle, by passing through a fibrous loop, forming a pulley, suspended from the inner upper corner of the orbit, very much as the tendon of the pyramidalis changes its course by running through the sheath in the quadratus. The six muscles serve as so many ropes to pull the eye in different directions, and change the axis of vision; and all taken together, as stays to steady it. In the figure they are cut away from their origins at the bony orbit, and reflected away from the eyeball, to give a fair view of the pyramidalis and quadratus. The reader must mentally collect the six dangling ends, and fasten them in the places above designated.

There are some other structures in the socket of the eye,

besides those already described, and the ball itself. There are nerves, arteries and veins. Of the first named, the optic, or sight-nerve, is by far the largest, and is in fact the only one that can be discerned without more trouble than most persons would be willing to take to see it, and more skilful dissection than most can make. It is described further on, as it can be more conveniently studied in connection with the ball itself. Other nerves go to the muscles of the eye. The *oculo-motor* divides into numerous branches, which are distributed to the inferior oblique, and all the recti except the external. The latter claims a nerve of its own (the *abducens*), and so, also, does the superior oblique, to which the *patheticus* is exclusively distributed. These nerves all come directly from the brain. We do not know why they are so unequally distributed. There are some more nerves in the socket which, however, do not particularly concern the eye, and therefore need not concern us. There is little to be said of the blood-vessels: they ramify everywhere, supplying all the structures of the eye with food. The arteries bring the nutritious fluid, and the veins carry it away when the nourishment has been extracted for the repair of the destruction that constantly goes on in all living tissue, and when it has become loaded with carbon, and other effete or deleterious matter.

So much for the surroundings of a bird's eye,—the setting of the precious stone: now we are prepared to look inside. An eye is a perfect microcosm, in which we find almost every kind of tissue that enters into the composition of the rest of the body. If the reader's interest has been awakened, as we hope it has, by what has gone before, we can, with confidence, invite him to look deeper into a bird's eye, and give him assurance that a far more beautiful "View" will be presented to him.—*To be concluded.*

THE WAVY-STRIPED FLEA-BEETLE.

BY HENRY SHIMER, M. D.

THIS beautiful little beetle, also called "Striped Turnip-fly" (*Haltica striolata* Fabricius) at the West, is well known and abundant. Every gardener is conversant with the fact that like fleas, grasshoppers, etc., it springs away to a great distance when he attempts to put his finger upon it. It appears in early spring, and is a constant annoyance to the gardener during the whole summer.

Fig. 1.

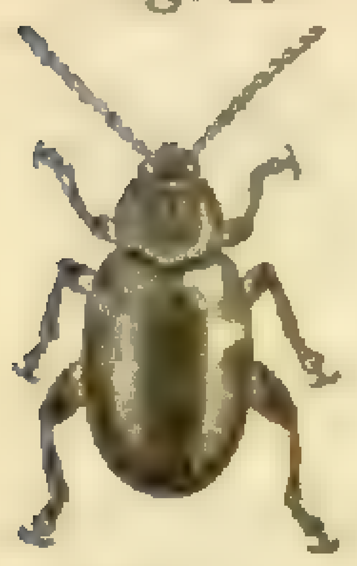


Fig. 2.

2*a*.

The Striped Turnip-beetle (Fig. 1) is less than one-tenth of an inch in length. Its general appearance is black, with a broad wavy yellowish, or buff-colored stripe, on each wing-cover. The larva (Fig. 2; 2*a*, pupa) is white, with a faint darkened or dusky median line on the anterior half of the body, being probably the contents of the alimentary canal seen through the semitranslucent skin. The head is horny and light brown. On the posterior extremity is a brown spot equal to the head in size; and there are six true legs and one proleg. In its form and general appearance it somewhat resembles the larva of the Cucumber-beetle, but it is much smaller. Its motion is slow, arching up the abdomen slightly, on paper or any smooth surface, in such a position that its motions are necessarily awkward and unnatural, because in a state of nature it never crawls over the surface, but digs and burrows among the roots in the ground. Its length is .35 of an inch, and breadth .06 of an inch. It feeds upon roots beneath the ground.

The pupa is naked, white, and transforms in a little earthen cocoon, pressed and prepared by the larva, in the ground near its feeding place. This period is short.

From my notes I see that on June 14, 1865, I put a

number of the larvæ into a breeding-box with a supply of their natural food. June 17th, some of the larvæ had disappeared beneath the ground. July 4th, I found in the box the beetle. This gives us seventeen days from the time the larva entered the ground, having ceased eating, until I obtained the perfect insect. I did not open the breeding-box every day, but as the insect was yet quite pale and soft, conclude that it was not more than a day or so out of the ground. The actual time, however, in the pupa state, was less than seventeen days, for, like the larva of the Cucumber-beetle and other beetles, these worms pass a kind of intermediate state, in a quiet, motionless condition, in their little dirt-tombs beneath the ground. During this time they decrease in length very much, becoming a shorter, thicker "grub." This period is a peculiar part of the larval state, and may be called the quiescent, or "shortening period," in contrast with the feeding period. At the end of this preparatory, shortening period, the little larva casts its skin and becomes a pupa.

During the past summer I bred a good number of these beetles from the larva and pupa, taken from their breeding places beneath the ground; but as I took no precise notes of the date, I can say no more regarding the time of the pupa state, except that it is short, only a few days.

Every gardener knows that these insects are very injurious to young cabbages and turnips as soon as they appear above the ground, by eating off the seed-leaves; he also almost universally imagines that when the second, or true plant-leaves appear, then the young plant is safe from their depredations, then the stem is so hard that the insect will not bite it, and the leaves grow out so rapidly as not usually to be injured by them; but if we would gain much true knowledge of what is going on around us, even among these most simple and common things, we must learn to observe more closely than most men do.

The gardener sees his young cabbage plants growing well

for a time, but at length they become pale or sickly, wither and die in some dry period that usually occurs about that time, and attributes their death to the dry weather; but if he will take the pains to examine the roots of the plants, he will find them eaten away by some insect, and by searching closely about the roots will find the larva, grub, worm, or whatever else he may choose to call it; from this he can breed the Striped Turnip-beetle, as I have often done.

I have observed the depredations of these larvæ for ten years, and most of that time had a convincing knowledge of their origin, but only proved it in 1865; since that time I have made yearly verifications of this fact.

Every year the young cabbage plants and turnips in this region receive great damage from these larvæ, and often when we have dry weather, in the latter part of May and early in June, the cabbage plants are ruined. A large proportion of the plants are killed outright in June, and the balance rendered scarcely fit for planting, but when the ground is wet to the *surface* all the time by frequent rains, the young plant is able to defend itself much more effectually, by throwing out roots at the surface of the ground, when the main or centre root is devoured by the larva; but in dry weather these surface roots find no nourishment and the plant must perish.

This year I saw these beetles most numerous in early spring, but have often seen them in August and September, so abundant on cabbages, that the leaves were eaten full of holes, and all speckled from their presence, hundreds often being on a leaf, and at this time the entire turnip crop is sometimes destroyed by them, and seldom a year passes without their doing great injury.

These observations are not entirely in accordance with the teachings of the masters in entomology. From Westwood's Introduction we learn that the Chrysomelians feed on the leaves of plants; that some of them attach themselves to the leaves to transform, and that others descend into the ground

for this purpose, but has no notes of species feeding beneath the ground. Harris was of the opinion that the Striped Cucumber-beetles, in the larval state, fed on the roots of plants, but was never able to find them. I have demonstrated, many years ago, that they feed on the roots of melon, cucumber, squash, and pumpkin vines, and ever since I attempted to raise any kind of vine, my greatest trouble has been *not to find them.*

The Chrysomelians, probably, as a rule, feed on the leaves of plants in the larval state, but in my limited researches I have found the majority of them beneath the ground. According to undisputed authority, they often congregate together in great numbers, and do great injury to the leaves of plants, even so as to compare with the ravages of caterpilars. I myself have observed some of this work.

As the Cucumber-beetle exclusively raises its young on the roots of the Cucurbitaceous (gourd) family, so from these observations I am led to believe from analogy, that the Striped Turnip-beetle raises its young always on the roots of the Cruciferous (mustard) family.

FERNS.*

BY JOHN L. RUSSELL.

The revelations of the science of geology have made it evident that in the early periods of the earth's history, especially in the formation of the coal beds, the ferns and their immediate allies formed no inconspicuous feature in the vegetation, and that the diminished and dwarfed forms of the present day represent the arborescent ones of that time. But what the present flora may have lost in majesty of size, it has gained in greater variety, and of the elegant and graceful

*A Fern Book for Everybody, containing all the British Ferns, with the foreign species suitable for a Fernery. By M. C. Cooke. Small 8vo, pp. 124. London, 1867.

proportions of many of the modern species, there are few or no traces in the past.

The interest which thus attaches to a fossil impression of an ancient fern, so exquisitely preserved that the venation of the frond (leaf) can be studied as a distinctive character, as well as in a fresh living specimen, cannot fail to render the whole family objects of attention, and help to induce a great many people, both old and young, to know something of its natural history. A taste for ferns has gradually sprung up and extended itself of late, and not a few have become enthusiastic botanists in this single speciality. Others have sought their cultivation as objects of special beauty; and floriculture has not deemed it beneath its domain to introduce them into artistic gardening. The delicate and tender foliage of some species, the fading tints of pale and tender golden yellow on their ripening in autumn, the evergreen lustre of others through snow, frosts and cold of winter, the curious capsules of others, or the grotesque variations of shape in stem and pinnated fronds of still others, have elicited admiration and interest. Wonderfully adapted to the artificial rock-work of picturesque gardening, and enduring, with a becoming hardihood, the changing character of so fitful a climate as ours, many of them, some even of foreign origin, claim the regard of the amateur cultivator. Others more tender and delicate, small and graceful, and of petite proportions, thrive under the ample bell-glass, or in the Wardian case, and help to enliven the parlor window in the wintry season of the year. Rich and costly collections of the fern plants occupy glass structures built expressly for them, and are more attractive in such luxuriance than far more specious and gaudy flowering plants. For it is, doubtless, familiar to the reader that the ferns stand at the head of a very large number of vegetable forms, which can boast of no flowering apparatus, to which neither involucre, nor sepal, neither petal nor stamen, neither pistil nor germen belong! They are the princes of the flowerless realm of

nature, provided with a singularly contrived apparatus, which but faintly and obscurely foreshadows the floral organs of other plants.

It were to be supposed that these plants, so common and widely distributed, would be known to everybody, growing as they do out of the crevices of rocks, springing up in the uncultivated fields, forming immense beds of growing and picturesque vegetation in the pastures, hiding the ground in the swamps, delighting the eye by their tender beauty in early spring, sprouting out in little graceful tufts from the stone walls, nodding and beckoning to their shadows as they are reflected in the water of the shady and cool well, or dipping into the pool or brook, but I have met with those who did *not* know what a fern was, even under its most familiar aspect. For such involuntary or willing ignoramuses, as well as for those who do know something and would know more of the ferns, the little work by Mr. Cooke, is specially and carefully prepared, and is what it purports, a "Fern Book for Everybody;" and well were it if everybody would learn from its humble and unpretentious pages what they can teach: something and enough at least to find the ferns are worth knowing. "It only professes to be a plain and easy guide to the study or cultivation of plants well known, and often described before, hence it contains nothing sensational or new, unless it be an increased effort to be plain and popular, so that persons who know nothing of the science of botany, or its technicalities, may learn something about ferns. Whilst all the British species are described and figured, and hints given for their cultivation, a number of hardy foreign species are also introduced at the close," etc. As several of the genera are common both to Great Britain and to New England, and some species likewise, the figures will materially aid any novice who seeks a cheap and reliable book for his first studies. This point will be farther considered in the succeeding remarks of the present notice.

The ferns are furnished with roots, horizontal or else upright stems, leaves technically called *fronds*, because they are not veritable leaves, and which usually rise from the ground curled up compactly, and gradually uncurling or unfolding and expanding laterally and longitudinally, while on the backs of them little pustules, or else uncovered spots filled or packed with a fine dust, are seen. Almost everybody supposes these dust-like heaps are the *seeds*, but the magnifying lens show that each particle of dust is a curious little casket, or box, or pocket, held together by a jointed and elastic ring. There are many modifications of this arrangement, but in a vast number of instances such is the normal rule. When sufficiently mature and ripe, the ring bursts, and the finer dust is thrown out of the little pocket. Each of these grains of finer dust is, in effect, a small living bud or bulb, and if sown on moist earth, or even on a piece of moistened sandstone, wetted window glass or sandy soil, will soon vegetate and grow, and produce a little dark green thin scale, deeply divided on one side, and when magnified it will be found to be a mesh-work of delicate cells. This scale is called the *prothallus*, and is totally unlike any organ in the higher plants. The prothallus on having obtained its full growth, will have attached itself to the soil or substance on which it has grown, by tufts of minute roots, and in one or more of its tiny cells, a sort of bud has been formed, which presently protrudes itself from its mother cell to meet little bristly-threaded filaments, which are endowed with motion, and which have issued from other nourishing cells on the same prothalline scale. After uniting, the first-named bud or buds grow into tiny stems, having roots of their own, when the scale or prothallus perishes, the young fern pushing forth its leaves, at first very small and unlike the subsequent and normal ones. In a year or more (perhaps even many years) the fronds assume sufficient strength, vigor and size, to make the pustules and heaps of dust on their backs, and the cycle of existence is complete. This

process, which I have often witnessed, is the only blossoming of the fern. It may grow for centuries and become an arborescent kind, such as formerly grew in the Coal periods, and such as now grow in the Sandwich Islands and at the Isthmus of Darien, *but no other blossom or flower appears!*

The dust of rare and valuable ferns collected in foreign countries, and kept closely sealed in phials from the dryness or moisture of the outward atmosphere, and from freezing, has been transported to other parts of the globe, and sown successfully raising living plants for conservatories and collections; those from the tropics being sedulously and carefully cultivated in hot-houses, kept at an uniform temperature the year round. Any one who may have become interested in this matter, may put it to the test by pursuing the plan here described, collecting the ripe dust from such species of ferns as may be within reach.

"That ferns are very beautiful, highly ornamental, and consequently attractive, will be admitted, but the utilitarian will be anxious to learn what are their uses? Such a querist will hardly receive a satisfactory answer if he confines the meaning of his word *use* to market value or to economic application. It is true that the *materia medica* derives small additions from ferns; a kind of food, in extreme cases, has been found in the stems of a very few species, but for clothing or shelter, resin, gum, oil, balsam, starch, dye-stuff, or any other product of the vegetable world which has its use and its market, none of these can be traced to ferns." (pp. 2, 3.)

A singular looking and rather pretty little fern, is the Adder's Tongue (*Ophioglossum vulgatum*), which has an erect stem six to twelve inches high, terminated by a club-shaped head, which is a modified leaf, or frond, and which is made up of the dust-cases or spores, such as usually grow on the back of the frond. Beside this, there is an expanded frond that is barren and devoid of spore-cases, and which looks not unlike the leaf of the dog's-tooth violet when half

grown. The old herbalists abroad attributed to the Adder's Tongue Fern rare virtues of healing, and even the poison of reptiles was supposed to be removed by its use. The Adder's Tongue is a native of this country, and I have met with it plentifully at Plymouth, and also at Hingham, where it was many years ago found by Mr. Jarnes S. Lewis of that town, and sparingly, there, in another section of the same town, by myself. The Moonwort (*Botrychium lunaria*) is another genus of the smaller British ferns, its spore-cases being so arranged on a stalk by themselves as to resemble a bunch of grapes. It is known there in this one species, but in the United States we have as many as five, four species besides the British, and several varieties. In England it has proved a difficult plant to cultivate, but I am assured by an eminent amateur in Ferns, that it grows readily when transplanted upon similar grassy land as that from which it was taken. Our *B. Virginicum* is a truly beautiful Moonwort and common in rich woods; and our *B. lunarioides* is subject to many curious variations. The Moonwort was especially a favorite with the witches, and Chaucer speaks of it as a choice herb with alchemists. The Osmund Ferns are showy and conspicuous, abroad represented in the Royal Fern (*Osmunda regalis*), and represented here in a slightly different form, growing, however, in similar situations, and deserving for beauty, grace, and bearing its regal name; beside this, we have two others, the Cinnamon Fern, and the Interrupted leaved Fern, well known to young botanists in the spring. The Polypods are ferns with elongated fronds, of which the common Polypody (*Polypodium vulgare*) is equally a British and a New England species. It is the pretty, evergreen, small fern which grows in matted tufts and beds, in the crevices and chinks of shaded rocks, and is readily cultivated on rock-work. Abroad, at least twenty varieties are known, of which the Saw-leaved (*P. serratum*) is the only one I have noticed growing wild here. Five other species are given, of which the Oak-polypody (*P. dryopteris*) and the Beech

Fern (*P. phegopteris*) are identical with ours. The Parsley Fern (*Allosorus crispus*) is a beautiful and "rather a local species, being found chiefly in mountainous localities in the north of England and Wales. Even there, a stranger may wander day after day and not meet with a plant for several days. The Parsley Fern is a very desirable plant for a Wardian case, or pot culture. It requires a little care in the cultivation, or it is apt to damp off from too much moisture at the roots. The fronds appear in May, and disappear with the early frosts of autumn." (pp. 52, 53.) We do not have this pretty fern, but it is represented in our *Allosorus acrostichoides*, or Rock-brake of Lake Superior, and of the northern and western parts of North America. The Jersey Fern (*Gymnogramma leptophylla*), found only in the island of Jersey as British, "is a little unpretending plant, of not more than two or three inches in height, and is not well suited to the Wardian case, growing most freely in the stove-(or hot) house. A native of Southern and Middle Europe, the isles of the Mediterranean and Northern Africa, it has also been found in Mexico." We are too far north for the Gymnogrammas, known as the Golden and Silver Ferns, and much cultivated for the beauty which a white or yellow mealiness on the back of the fronds gives them. "The Boss Ferns, or as they are sometimes called, Buckler Ferns, include some of the commonest and best known of British species. Their generally accepted botanical name is *Lastrea*. Most of the species are large and easily cultivated in pots or in the open air." Three of these have once divided fronds, four others have twice divided fronds, and one besides has thrice divided fronds. Of these the spiny Boss Fern is represented in our Shield Fern (*Aspidium spinulosum*) and its varieties, and the genus in other species is quite distinct. The British Shield Ferns, in the Holly Fern and Prickly Fern, have representatives with us, and there is one besides which we do not possess, and also another, finer than all, the *Aspidium acrostichoides*, common and beautiful,

evergreen all the year, easily cultivated, and worthy a search for it in shaded ravines and on bushy moist hill-sides. The soft Shield Fern is European, and of "this very sportive fern there are no fewer than sixty varieties, the handsomest of all is undoubtedly the *A. plumosum*, in which the fronds will reach nine inches in width, and nearly three feet in length: it has a spreading, plume-like habit, but is unfortunately a gem which is 'rare' as well as 'rich.'" A very common fern, but one of much delicacy, found with us in moist rich woods, and which in the autumn turns to a rich yellow and fades into nearly white; sought for winter boquets of dried leaves, is, for some unknown reason called abroad, the Lady Fern, and botanically, for a known reason, termed *Athyrium*, on account of a marked difference in the shape of the little scale, or *indusium*, which covers the spore dust on the back of its pretty fronds. It is the *Asplenium felix-femina* of our manuals, and one which is subject to great variation, having been considered, in one condition, a distinct species. It is easily cultivated and much esteemed in England, where it runs into many more varieties than with us, or so because these variations have not been so minutely noticed or carefully recorded. There are "sixty or seventy recognized varieties of this fern which are in cultivation; a few are attractive. The tasselled is one of the greatest favorites; the most singular is known by the name of *Frizellia*, in which the fronds are not an inch in width, with kidney-shaped leaflets divided into two parts, which overlap each other and are toothed at the edges; these are attached to each side of the leaf-stalk." Some pretty lines on this fern run to this measure:

> "If you would see the Lady Fern,
>   In all her graceful power,
> Go look for her where woodlarks learn,
>   Love songs in a summer bower.
> But not by burn, in wood or dale,
>   Grows anything so fair,
> As the plumy crests of emerald pale,
>   That waves in the wind, or sighs in the gale
> Of the Lady Fern, when the sunbeams turn,
>   To gold her delicate hair."

The Spleenworts are all delicate and some are pretty little ferns, so-called on account of some supposed efficacy in the diseases of the spleen. They are technically called *Asplenium*, and although seven of the British species are unknown to our flora, yet we have two that are identical, and seven besides which are not British. The Wall-rue (*A. ruta-muraria*) may be found in our limestone cliffs, at Burlington, Vermont, and Trenton Falls, N. Y., and quite as pretty as in North Wales. The common Wall Spleenwort (*A. trichomanes*) is common about Salem under the shaded rocks of the Great Pasture, and known by its shining black leaf-stalks and simply pinnate oval leaflets. In England where it is plentiful, it is sometimes called the Maidenhair Spleenwort, a "not uncommon species being widely distributed over the British isles, but amongst rocks, old stone-walls and ruins it is most abundant. The walls of loose stones piled on each other, which skirt the roads in North Wales, are often green for miles with tufts of this fern." There are nine or ten varieties in cultivation, the most delicate being the *A. incisum*, the leaflets deeply cut, "each of which is like a fan of spreading, long, narrow lobes." In Scotland this fern had once some repute as a medicine for coughs and colds. For the British Sea Spleenwort, Rock Spleenwort, Bristly Spleenwort, Black Spleenwort, we must content ourselves with the New England and Western Pinnatifid, Ebony-stemmed in two species, the Mountain, the Narrow-leaved and the Thelypteris-like Spleenworts, which will reward the seeker, if haply he may find them all, and of some he cannot fail. But of the Hart's-tongue Fern, "found everywhere, on hedge banks, old walls, on the sides of wells, and in a variety of situations, accommodating itself to the various conditions in which it is placed; easily grown and indispensable both to the out-door fernery and the greenhouse, small plants growing with effect in a closed case;" the Hart's-tongue, I am fain to acknowledge is a very rare American fern, and oftener to be seen in greenhouses than in its native haunts.

It was discovered by Pursh among loose rocks near Onondaga in Western New York, more than fifty years ago; and long unknown until lately found under the limestone cliffs of Chitteningo Falls, in Pursh's locality, and elsewhere as in Canada West. It is a very interesting fern, the frond being like the blade of a knife, auricled or heart-shaped at base, the spore-dots in parallel lines on each side the midrib, reminding you of the Scolopendra, or Centipede, and is easily cultivated and grows readily from spores, as I can testify by actual experiment.

Thus esteemed and common in Great Britain, under cultivation, it has originated a good many varieties, such as the Crisp-fronded, the Crested, the Forked, the Proliferous, the Endive-leaved, the Rugged, the Broad-branched, the Kidney-shaped, and others with minute differences. Those, however, who prefer "nature unadorned" had better turn to Silliman's Journal, for May and September, 1866, and see there a full account of the American Hart's-tongue, identical, though it be, with the British, *Scolopendrium vulgare*, found elsewhere, and also flourishing in the Azores with other interesting species of those islands.

The Scale Fern (*Ceterach officinarum*) "sometimes called Rusty-back, because the whole under surface of the fronds are of a rusty-brown color, from the numerous brown scales which cover them," is a very nice affair, and though "widely distributed," fails us with its presence here. We must be content with many species which fail our British friends, who, so far as the Ceterach, with its ambiguous oriental name is concerned, is better off than we; but in their Hard Fern (*Blechnum*) we have a Southern species which will answer our purpose as well as their own; and then the *B. spicant* of Europe and England, has twenty or more varieties, which must be interesting to the amateur pteridologist or fern lover. The Bracken (*Pteris aquilina*) is a noble fern, only too common with us, who have no wild game and deer to seek a covert among it. The stem cut across exhibits the outline

of a double-headed eagle, as some imagine, whence its name, from *aquila*, or Eagle Fern, an Austrian conceit, perhaps. Its ashes are used by soap boilers and glass manufacturers. A fine native variety of this is the *caudata* of the Southern United States, with the segments, and especially the terminal ones, elongated; and two others beside are Southern. Thus there are three North American "brackens," and a variety in all three, to set against the British one. And as to our beautiful Maidenhair (*Adiantum pedatum*), which grows in the rocky ravines of Danvers, Salem, and its vicinity, we are told that it is "more hardy than the British, succeeding either in the open air or in a greenhouse," but I can aver that the *A. Capillus-Veneris* of England is a lovely fern, and a choice companion for its American sister.

The Bladder Ferns (*Cystopteris*) appear in three species in the British flora, and in two in ours; elegant ferns and easy of cultivation; one, the fragile Bladder Fern, creeping out of limestone and granite crevices alike, and from the interstices of old walls; and a bulb-bearing one furnished with the most cunning little green balls on the pinnæ. I have them both in cultivation, the former British too, but the Royal and the Mountain Bladder Ferns are not represented here; the latter is exceedingly pretty. The *Woodsias* are two, one identical with our own, the *W. Ilvensis*, a hairy little fern, which grows in woolly tufts, so patient of summer droughts on our sunburnt rocks. And against the Alpine Woodsia we must set three that are North American. The British Filmy Fern (*Hymenophyllum*); was there ever anything more delicate "on rocks which are continually moist or subject to the spray of water-falls, and not uncommon in rocky mountainous districts?" but it is principally represented in tropical regions in many species; in England in two, while another British Fern closely related to *Trichomanes radicans*, "on dripping rocks beneath the spray of water-falls, and confined to Ireland," is found in Alabama and Tennessee, with another and tiny species, its minute and

tender fronds sprinkled with spray, which was discovered by Peters, in Alabama, and dedicated to him as *T. Petersii;* occurring also in mosses sent from Pensacola, Florida.

Having thus cursorily glanced at the British types of the fern genera, and compared the species with our own, we leave to the amateur cultivator, to find in our botanical text books and manuals, many North American ferns beside, worthy attention and exclusively native here. That they have, however, received attention abroad, will be manifest by examining the list of "Exotic Ferns" appended to the main work we have had under consideration. In our Climbing Fern, Aneimia, Nephrolepis, Onoclea, Walking-leaf or Camptosorus, Cheilanthes, Pellea, Vittaria, and several Polypodiums, with the golden rhizomed Acrostichum, and the majestic Ostrich Fern, beauty, elegance, grace and novelty will be found.

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER, M. D.

THE following notes refer to animals collected or seen in the Rocky Mountains, between Fort Benton, Fort Colville, and Fort Vancouver, Washington Territory, July 1st to November 1st, 1860.

I. MAMMALS.

BAT (*Vespertilio*, species? No. 68 in alcohol). I found this Bat under the bark of a dead tree in Hell Gate valley, over 4,500 feet above the sea. It had been flying about a little in the bright sunlight an hour before it set, but returned to this shelter as if dazzled, though it could see plainly enough where to find a dark place. I saw no other during the journey that I can now recollect.

SHREWS (*Sorex*, *Blarina*, *etc.*). I mention these here,

merely to remark that at the western base of the Cœur d'Aleñe Mountains, I saw two shrews in one day running swiftly over some of the gigantic prostrate logs of arborvitæ. The day was dark and damp, as is said to be the common climate of that region, and this being the only occasion when I saw any of these animals, during the journey, they had probably been enticed out by the weather. The locality is remarkable for these animals, being about 4500 feet above the sea.

GRAY WOLF (*Canis occidentalis*). The Gray Wolf was rarely heard or seen.

COYOTE (*Canis latrans* Say). The Coyoté was more common, but none were killed.

OTTER (*Lutra Canadensis*). Signs were observed; entirely a cross of this or *L. Californica*, or both, as they are probably identical.

BADGER (*Taxidea Americana*). Burrows seen everywhere.

GRIZZLY BEAR (*Ursus horribilis*). None were seen by the party west of Fort Benton, though some below, and the Falls of the Missouri is mentioned, by Lewis and Clarke, as a great resort of this animal. But few tracks were seen, consequently we may suppose it to be rare in the northern mountains, which are almost everywhere densely timbered; and it seems equally scarce in the Great Plain of the Columbia, north of latitude 46°, which is hemmed in on three sides by wooded mountains. Some, however, are doubtless found on the eastern range of the Rocky Mountains.

BLACK BEAR (*Ursus Americanus*). Some bear-meat, obtained at "Hell Gate," was of this species, which is said by the residents there to be very common, and I frequently saw its tracks in the thick woods, which seem to be avoided by the Grizzly Bear.

RICHARDSON'S SQUIRREL (*Sciurus Richardsonii*). I saw no true Squirrel in the eastern Rocky Mountains, though pines were abundant enough to supply them food, but from the vicinity of Hell Gate, westward, even to the summit of

the Cœur d'Aleñe Pass, 5,100 feet above the sea, this squirrel abounded. It seemed to feed on the seeds of every coniferous tree without preference for any one, and obtained the seeds by dropping down the cones, from near the tree tops, to the ground, where it could open them at leisure, usually sitting on a log or low branch to do this, after having bitten off a number of cones. I obtained the best specimens of cones of *Abies amabilis* by the aid of the squirrels, who frequently came down when they saw me looking about the tree, and scolded with the same fearlessness shown by the Chickaree (*S. Hudsonius*) and the more western *S. Douglassii*. Indeed this animal exactly resembles the latter in habits, cries, and general appearance, both differing very little from the Chickaree in these respects. In the cool climate of these northern forests, they seem rarely to build summer nests like the Atlantic species, though such nests are sometimes seen in the branches.

In the Rocky Mountains I found no nuts except those of the pine, even hazel-nuts being absent south of Fort Colville, and acorns east of the Columbia.

Missouri Chipmunk (*Tamias quadrivittatus*). This little Chipmunk I saw in the bare rocky hills of the Mauvaise Territory, fifty miles west of Fort Union, Nebraska, and though I saw none near Fort Benton, I doubt not but they inhabit every rocky locality from Fort Union, west, as I found them again as soon as we reached the foot of the Rocky Mountains, and thenceforward not a day passed without my seeing many of them, until I got fairly out of sight of trees on the Great Plain of the Columbia. I can confirm the remark made by me in 1853, as to the Chipmunks seen in the Yakima valley being of this species, from their color, habits, and want of the shrill alarm-cry of the *T. Townsendii* (like that of *T. striatus* also). But the specimens found on the plains and in the forest differ so much in color and habits, that had I not seen many intermediate shades, I should certainly consider them distinct species; and as I

have never seen them *quite* beyond the range of coniferous trees, I suppose that the smaller, gray or faded, variety inhabiting the extreme edge of the woods, owes its distinction to the influence of more sunlight and heat, combined with inferior food. It is like the half-starved population of an over-crowded region, barely subsisting on what can be picked up on the border of the desert; for, though other rodents thrive on the grass, seeds, etc., of the plains, the Chipmunks evidently require nuts. I have seen them ascend pines one hundred and fifty feet, where they extract the seeds from the cones and carry them off in their cheeks, instead of cutting off the cones like the true squirrels.

Variations in color, connected with exposure to the sun and heat, are noticed also in *T. Townsendii* and *T. striatus*, as well as in other animals, so that much allowance must be made for such influences in the determination of species. The variety found by me in 1863, at the Clickatat Pass, Cascade Mountains, 4,500 feet above the sea, and at first named *T. Cooperii* by Professor Baird, is so nearly intermediate between the form found on the west (*T. Townsendii*) and that east of those mountains (*T. quadrivittatus*), as to suggest a doubt of their distinctness, and at least a suspicion of a hybrid race. (P. R. R. Mammals, VIII, 302.)

Richardson's Spermophile (*Spermophilus Richardsoni*)? On the bare plains between Fort Benton and Sun river, I saw a few specimens of what I supposed to be this animal, and its burrows were numerous in a few spots where the soil was rich, soft, and rather moist. Like other species in Indian countries, it was so very shy that I did not succeed in killing one, but one seen quite near, when I had no gun, agreed in size, color, ears, etc., with the description of the above species, originally found north of Fort Benton.

As every species of this numerous genus I have met with (eight in all) has different habits, even in its mode of burrowing, I may remark that this species prefers soft ground, carries out little earth to the surface, and has several entrances

near together, with galleries communicating at a slight depth. I saw no signs of its burrows in the harder soil which prevails on most of the plains.

Burrowing Squirrel (*Spermophilus grammurus*?). The "Burrowing Squirrel" of Lewis and Clarke, which has so much puzzled both field and closet naturalists ever since their time, was undoubtedly, I think, founded on at least two distinct animals. Their description of the fresh specimen agrees precisely with that given by Dr. Suckley, of *Arctomys flaviventer* (from a recent specimen also), excepting the length of tail, which in the former may have been mutilated, or the length misprinted; otherwise, the words may be paraphrased almost word for word. But their description of the habits of the squirrel indicates quite another animal, whose burrows now exist as abundantly as in their time, throughout the prairies and more open pine woods, from near the summit of Mullan's Pass to Fort Colville, avoiding only the dense forests, and doubtless passing round the Cœur d'Aleñe Ridge, by way of Clarke's Fork and its tributary valleys.

As so well described by them, the burrows occur in villages like the Prairie-dogs, but with several smaller entrances around a central mound of excavated earth, the holes large enough to admit any of the largest Spermophiles. Though abundant, the squirrels are so very shy that I saw only four or five, and if I killed any they got too far down in their burrows to be got out, as all I shot at were sitting at the mouth, and like all these burrowers, their last kick is an effort to get downward. In this shyness they differ wholly from the Prairie-dog, and indeed have far more the habits of a Spermophile. As well as I could see, they had the size, proportions, and color of the species mentioned (*grammurus*), which, according to a specimen label, was found by Townsend on the Columbia river (Baird's Gen. Rep. Mammals, p. 310). Those I saw were silent and watchful, seeming rarely to go far from home, and thus differing much from S.

Douglassii and *Beecheyi*, both of them closely allied to it, but which are, on the contrary, very fearless of man, diurnal in habits, and often wander considerably. As before remarked (under *S. Richardsonii?*), all these animals are wildest in the Indian country, though much hunted by whites where they abound. Our guide, Mr. Sohon, tried to get specimens for me through the Indians, but they said it was a very hard animal to catch, and my experience of trials with traps, strychnine, etc., confirms their opinion.

The last burrows I saw of this animal were within fifty miles south of the Spokan river. Lewis and Clarke, in speaking of their villages occurring on all the prairies, may have confounded the burrows of other animals with this (as *S. Douglassii* near the Dalles), and certainly it is not found west of the Cascade Mountains, where they probably got the specimen of Arctomys (?) they describe, as they collected most during their winter residence at the mouth of the Columbia.

PRAIRIE-DOG (*Cynomys Ludovicianus.*). The last Prairie-dog village occurred on the plain between Sun and Dearborn rivers, none inhabiting the hills we then encountered, so that I very much doubt their occurrence in Washington Territory, where the "Burrowing Squirrels" take their place.

YELLOW-FOOTED MARMOT (*Arctomys flaviventer*)? Very near the dividing ridge of the Rocky Mountains, on the east side, I saw an animal, undoubtedly a "Woodchuck," which got into its burrow before I could shoot. Its low broad back, and short flat tail, were very plainly visible, and its color seemed to be dark brown. The burrows often taken for those of the Badger may be sometimes this animal's, as its size and mode of digging are similar. A specimen of this species, preserved by Colonel Vaughan, at Fort Benton, was caught in the Rocky Mountains, thus indicating that the one I saw was probably the same.

BEAVER (*Castor Canadensis*). Beavers were seen almost every day, from the steamboat, while ascending the Missouri river, and were remarkably fearless for an animal usually so

shy, sometimes sitting on the bank until the boat got within a hundred yards of them. Their burrows, made in the bank near the mean water level, were, when inhabited, concealed by a large pile of branches, which would have seemed an accidental drift to a casual observer, but if closely examined, showed design in their arrangement, the cut ends all lying above water in one direction, and the others seeming fixed below by sand or clay piled on them.

Near the source of the Little Blackfoot river were many ponds formed by beaver-dams, and I have everywhere noticed that these are constructed in shallow water, probably to deepen it, none being required in larger streams with banks suitable for burrowing in. Beavers seem rarely to build houses in Washington Territory, as they do in colder climates.

PRAIRIE MOUSE (*Hesperomys Sonoriensis*). This widely spread Mouse is common at Fort Benton, and was also taken at St. Mary's valley, Washington Territory, in 1853, by Dr. Suckley. Like *H. Gambelii*, and some others, it lives in holes burrowed in the open prairie, far from tree or bush, while *H. leucopus* and *Nuttallii* never seem to leave the woods. Has not this difference in locality caused variations in color, etc., which have led to incorrect specific distinction? (See *Tamias*).

ROCKY MOUNTAIN WOOD-RAT (*Neotoma cinerea*). On the banks of the Missouri, above Fort Union, were frequently seen large nests built in the low forks of willows and poplars, some of them large enough to form a good load for a handcart; probably measuring four feet through, and in form more or less spherical. They were composed of twigs, about half an inch thick and a foot long, dry, and densely interwoven. The soldiers and others called them "Eagle's nests," but finding them without any cavity, and much like the nests of *Neotoma fuscipes* of California in structure (except that that species usually build on the ground), I decided that they were built by the species here mentioned. Dr. Hayden found

it inhabiting the hollow trees on the Yellowstone, and it may build these summer-houses in the branches to avoid the flood which occurs at the breaking up of the ice in spring, the water being dammed up in this part of the river so as to raise it several feet above its banks, and much higher than in the summer rise. From the east base of the Rocky Mountains, entirely across, I found signs of this animal, usually a pile of cactus or other thorny stems, protecting its holes among the rocks, and further west, large piles of twigs for the same purpose. I saw no signs of it, however, in the Cœur d'Aleñe Range or on the Columbia Plains, so that it seems widely separated, locally as well as physically, and in habits, from its nearest relative the *N. occidentalis*, or bushy-tailed Rat, west of the Cascade Range. I did not succeed in trapping, shooting, or poisoning a specimen.

PLAIN MOUSE (*Arvicola pauperrima*, nov. sp.*? No. 126). Great Plain of Columbia, near Snake river, Oct. 9, 1860. If mature, this specimen is certainly distinct from any of the many other species described by Baird and others. I found it common on the Great Columbian Plain, after getting quite out of sight of trees, and where the ground is covered uniformly with a coat of short scattered grass. Its burrows were the only ones observed there, and by looking a few yards ahead, while my horse walked quietly along, I could see many of the little inhabitants sunning themselves during the noonday heat, or running swiftly from hole to hole. The only one I could get was caught in a rut of the road, which was too deep for it to climb out of, though only about three inches.

It was even more abundant on the grassy rolling hills between Snake and Walla Walla rivers, and all I saw seemed to be of about the same size as this specimen. Scarcely any other animal was to be seen where this lived, and water was not to be found for distances of twenty miles, so that in

*Dimensions: head, 1 inch; body, 3.87; tail, vert., 0.75; hairs, 1.00: fore-arm. 0.87; hind foot, 0.62; ear, 0.25×0.38.

summer its powers of enduring thirst must be great, unless it gets enough dew on the grass to supply its wants.

Prairie Hare (*Lepus Townsendii*). This hare is common east of the Rocky Mountains, and was seen on Deer Lodge and other high places west of their summit, but as in 1853 I found none on the Columbian Plain, though the climate and vegetation seems well adapted for them. Their numbers seem never to have increased much north of the Columbia and Snake rivers since the epidemic (small-pox?) destroyed them several years since, but south of those rivers they become common. It is a question whether an epidemic really made them scarce northward, or whether the prevalence of uncommon deep snow did not enable the Indians to kill more of them, as with deer and antelopes.

Sage Hare (*Lepus artemisia*). This small species is more rare near Fort Benton, and I did not see it west of the mountains, except among the Artemisia bushes at Old Fort Walla Walla, Townsend's original locality. Near Fort Laramie it frequents, chiefly, the rocky places where it can hide in holes, not trusting to its speed on the open plains, like *L. Townsendii*, and is therefore very rare, if found at all, on the bare plains. The eastern *L. sylvaticus*, so similar to it as to be scarcely distinguishable, seems to extend its range along the Missouri and Platte rivers. The difference in color, which is the chief distinction, is analogous to that seen in the two varieties of *Tamias*, etc., inhabiting the woods and the plains.

Caribou, or Woodland Reindeer (*Rangifer Caribou*)? About twenty-five miles above the Bitterroot ferry, in crossing a high hill near the river, I noticed by the roadside a pair of decayed and broken horns, which looked like those of the Woodland Reindeer, before reported to inhabit the Northern Rocky Mountains, and from which a district of British Columbia has been named Caribou. These horns were more slender and elongated than that represented by Baird (Mammals, p. 634), but he remarks that scarcely any two pairs are alike.

AMERICAN ANTELOPE (*Antilocapra Americana*). Very abundant along the upper Missouri, and to the Rocky Mountains. Some were also seen west of the summit in Deer Lodge Prairie, and probably frequent all the larger plains as far as the Bitterroot Mountains. West of these, however, it seems to be very rare. In Washington Territory, though, I was informed by Capt. Fraser, U. S. A., that an old hunter, living at Spokan river (Antoine Plante?), once got lost in the Great Plain, towards the most westerly bend of the Columbia, a region uninhabited, and almost unknown to the Indians; that he there saw large herds of Antelopes. Also, that they were formerly abundant on this plain, but that during a very deep snow, some years since, the Indians slaughtered hundreds of them (as before reported of the deer), since which time they have been scarce. This is quite likely since snow is sometimes quite deep on portions of these plains, and since the introduction of fire-arms the Indians have killed more game. There seems to be some foundation for the belief that the horns of these Antelopes are deciduous, from the fact that some which I have seen had the terminal and outer layers of horn peeling off like a sheath, but this may not be a constant occurrence.

ROCKY MOUNTAIN GOAT (*Aploceras montanus*). The Rocky Mountain Goat is almost unknown to the traders at Fort Benton, but Mr. Dawson told me that skins were now and then brought in there, coming from the Bitterroot Mountains, near the sources of the Kookooskee, one of the loftiest portions of the central chains, and from which rivers flow in all directions. The summits there are above the line of perpetual snow, and just below this is a zone of grassy country inhabited by these animals, while still lower the densest forests prevail, totally unsuited for them, and extending more than 5,100 feet above the sea, the height of the Cœur d'Aleñe Pass. This animal is quite unknown to hunters who have spent their lives in the mountains south of latitude 42°, though its almost inaccessible resorts are so little visited,

even by them, that it may exist there. Maj. Haller, U.S.A., told me that the Indians near Wenatchy river, in the Cascade Mountains, catch them in the deep snow by rushing down upon them from above, on snow-shoes. As they always look for danger from below, this mode of surprising them is not improbable, and besides, these mountain animals run up hill much more easily than down.

MOUNTAIN SHEEP (*Ovis montana*). The Bighorn is common in the rugged bare hills along the Missouri, from Fort Union west, and throughout the Rocky Mountains to the Cœur d'Aleñe Range, but since the time of Lewis and Clarke seems to have disappeared from the cliffs bordering Snake and Columbia rivers, probably on account of the use of fire-arms by the Indians.

THE BUFFALO (*Bos Americanus*). Last summer (1860) the Buffalo herd of the upper Missouri was spread from the Rocky Mountains, near latitude 49° south-east, and we found them along the Missouri from its upper Great Bend west to about fifty miles above Milk river, but nowhere in great numbers. Remains of their skeletons, left about five years since, were abundant west of Fort Benton, and I saw one or more old skulls daily in the valley of the Little Blackfoot and Hell Gate rivers, quite down to the junction of the Bitter-root. Large herds have sometimes visited the west side of the summit, especially Deer Lodge and St. Mary's valleys, but not for many years past. If they ever reached the Columbia Plains, it was probably by way of Snake river, as they would scarcely try to cross the Cœur d'Aleñe Range, where grass is very scanty and the timber very dense. I saw no difference in the skulls, indicating a different species, or "Mountain Buffalo" of the hunters. (The Bighorn is sometimes called so.) The horns showed that most of the animals were very old bulls, being enormously thickened, and their lower part scaling off. This accounts for the large size and solitary habits of these "Mountain" specimens.

EARTHQUAKES.

BY W. T. BRIGHAM.

Earthquakes and volcanoes are at last claiming, by their very intrusive activity, the attention of observers, who are able to look through the smoke of an eruption, and the dust of an earthquake, at the real geological importance of the terrible demonstration. Within the past two years the earth has been strangely unquiet. First Vesuvius sputtered forth feebly in its old age; then Santorini smoked and steamed, and extended its little territory; then Central Europe shook a little, and the tremor extended through Asia, and into the Pacific, where a new island came to the surface near the Samoan Group. All these were but premonitions, and last spring, while the vibrations were being repeated on the eastern continent, the huge volcanoes of the Hawaiian Islands broke forth with a violence unknown there for centuries. The earth heaved and opened, the craters of Kilauea and Mauna Loa poured forth their lava streams, and finally the sea rushed upon the shore destroying animals and men. To this day the island shakes, but the movement is so slight that little notice is taken of it. Not so remarkable as this Hawaiian earthquake, nor so admirably adapted for scientific research, but far more destructive to life and property, was the terrible earthquake of the South American coast this summer. The commotion was so violent, that the impulse given to the sea extended through the whole Pacific, reaching even to the coast of Kamtschatka.

While the scratches of the pebbles, frozen into a block of ice, claim and gain the attention of geologists, strangely enough, the far mightier forces which build up those mountain ranges, and which have modified much of the earth's crust, are comparatively neglected. It is true that M. Alexis Perrey, in France, has collected since 1842, all evidence attainable relating to earthquakes, which he has published

in annual catalogues; and Robert Mallet, in England has collected similar evidence in his "Catalogue of Recorded Earthquakes, from 1606 B. C., to A. D. 1842," and has done a very important work in his investigation of the great Calabrian Earthquake of 1857. With these exceptions, very little of importance has been done to investigate the causes and seasons and effects of earthquakes; and geologists do not as yet know whether the shock is caused by the falling of huge masses of rock into subterranean caverns, by the explosion of gasses pent up in the bowels of the earth, by the evolution of steam when water reaches the heated interior of the globe, by the surges and tides of an inner molten sea, acted upon by the moon's attraction or terrestrial revolution, by the gradual contraction of the earth's cooling crust, by the waxing and waning of the internal heat locally, by some unknown law, or by any of the other causes so ingeniously suggested, most of which are as probable as the subterranean convulsions of an imprisoned Titan.

Catalogue makers have to trust to evidence which has become more or less distorted in passing through many hands; they do not see for themselves. When an earthquake takes place, everybody is caught unprepared, and if not killed, yet so terribly frightened, as to be wholly unfit to describe events exactly as they took place. The evidence of one good observer, who examines the ground after it has all passed, is of more value than a score of newspaper reports at the time. But our geologists all live far away from earthquake countries, and only a return to the shakes, which took place in New England a century ago, will wake them up to the importance of seismic* studies. Let us not feel too secure among our granite hills.

New England has been visited by a number of earthquakes since the Pilgrims landed in 1620. The first was in 1638, and twenty years later occurred what is called a "great earthquake," but no descriptions have been preserved. In

* *Seismic* means relating to earthquakes; from *seismòs*, an earthquake.

1663 (February 5), a severe shock was felt in Canada, New England, and New York, severe enough to open and shut doors, ring bells, split walls, and let floors fall through; and while the first shock continued nearly half an hour, a most uncommon thing, the secondary shocks continued at intervals until July. In 1727, an earthquake occurred in the territory between the Delaware and Kennebec rivers, centreing, apparently, near the Merrimack river. Springs changed their place, and some dried up; the water in wells was rendered turbid and unfit to drink, so that people pumped the wells dry thinking some carrion had fallen in. November 18th, 1755, a shock threw down about a hundred chimneys, and about fifteen hundred were shattered more or less in Boston. The ends of twelve or fifteen brick buildings were thrown down from the top to the eaves of the house. The duration of the shock was nearly four and a half minutes. On the same day the sea withdrew from the harbor of St. Martin's, in the West Indies, leaving vessels high and dry, and on its return the waves rose more than six feet above high-water mark. This was nine hours after the shock was felt in Boston. Since then no severe shocks have been felt in New England, although a band of extinct volcanoes extends through its midst, curving from Montreal to New Jersey.

These gentle breathings of Mother Earth become terrible gasps and spasms in other regions, and as examples of her terrible power, the earthquake of Lisbon, and the repeated shocks of the Andean region, may be here recalled.

November 1st, 1755, about half past nine in the morning, a sudden subterranean noise was heard, and in a few seconds the principal buildings of Lisbon were in ruins. It was a *fête* day, and the churches were crowded; the high steeples and the solid walls fell together, and thousands of people were crushed beneath the ruins. People in the upper stories of the houses were generally more fortunate than those below, or in the streets, but it was believed that sixty thousand perished on this terrible day in Lisbon. To add to the hor-

rors of the scene fire broke out among the ruins, a violent wind arose, and in about three hours the city was reduced to ashes. Immediately after the shock, a huge wave entered the Tagus, forty feet higher than the water had ever been known to rise before, but the bay received most of its violence, and it at once subsided. The quay was thronged with people, and it suddenly sank, and no body ever floated to the surface. Where the solid wall had stood the water was many fathoms deep. At Cadiz the sea wave was nearly sixty feet high, and did great damage. According to Humboldt's computation, a portion of the earth's surface, four times greater than all Europe, was simultaneously shaken; even our great lakes felt the commotion, and tides of considerable height were observed on their shores.

During the years 1811–12, earthquakes were felt in South Carolina, and more violently in the valley of the Mississippi, where, at New Madrid a whole grave-yard was pitched into the river; and the violence finally culminated in the destruction of Carracas, burying ten thousand of its inhabitants beneath its ruins. In 1835, an earthquake was felt between Copiapo and Chiloe on the north and south, and the island of Juan Fernandez, and the city of Mendoza, on the west and east. Conception, Talcahuano, Chillan, and other towns were thrown down, and immediately after the shock the sea retired in the Bay of Conception, and the vessels grounded where had been seven fathoms of water. A wave soon rushed in and retreated, and was succeeded by two others probably not more than sixteen or twenty feet in vertical height. In November 1837, Valdivia, in Chili, was destroyed, and in January of the same year a shock devastated Syria, destroying more than six thousand people, and making itself felt over a territory five hundred miles long by ninety wide.

The earthquakes, then, of the present year are no novelties, however dreadful they may seem, but they offer many interesting features, and although no scientific man has yet published any account of the earthquake of St. Thomas, that

of the Hawaiian Islands, or of Peru, it may be well to briefly recount the facts.

At St. Thomas no less than five hundred shocks of earthquake were felt, from the middle of November to the second of December, 1867. The inhabitants had abandoned their houses, and dwelt in tents on the hill-sides. November 18th was a clear, beautiful day, the ocean was almost calm, and the sun was bright and warm. Not a sign foretold the approaching catastrophe, when at a quarter before three in the afternoon, the usual underground rumbling was heard as of distant thunder, and immediately the earth rose and fell in small waves for about a minute, while the subterranean noise was dreadful. No one could stand. The sun seemed to have lost his power. After the first shock, the ground kept quivering for about ten minutes, when another strong shock was felt. Before the first shock, the ocean had receded several hundred feet from land, and it now returned as a huge, straight, white wall, smooth and even as a wall of masonry, and eighteen to twenty-five feet high. It moved with considerable velocity, upsetting all small craft, and raising large vessels to its top. The lower part of the shore was submerged to a depth of two or three feet, and to a distance of two or three hundred feet inland. An even larger wave succeeded this, at an interval of about ten minutes, and as this passed away, the ocean remained calm as before the first shock.

At St. Croix, the U. S. steamer Monongahela was thrown high and dry upon the shore. The waves receded rapidly, and at once rose in a wall nearly thirty feet high, white as snow, and hissing with spray. This huge wave carried everything before it, and it was repeated several times with nearly equal violence, when, as at St. Thomas, the sea became quite still.

Between 4 and 5 o'clock, P. M., on Thursday, April 2d, 1868, an earthquake occurred on Hawaii, centreing on the southern slope of Mauna Loa, far severer than before re-

corded on the group. Houses were destroyed, cliffs hurled down, fissures opened in the ground, the whole earth seemed in violent motion, and an earthquake wave drove the sea over the southern coast in places to a height of twenty feet, sweeping away all the shore villages. Five days later lava broke out on the higher slopes of Mauna Loa, and flowed into the sea. Kilauea, at the moment of the great earthquake of April 2d, began to empty itself by some subterranean channel, and is now five hundred feet deeper than in 1865. This whole eruption and earthquake, more remarkable than any of the others of the past year, deserves a fuller description than can be given here. The newspaper reports are filled with errors and misstatements.

Finally, in this series of disturbances, we have the terrible earthquake which, on the 13th of August last, caused so great destruction of life and property on the coasts of Chili, Peru, and Ecuador. At Arica, lat. 18° 30′ S., long. 70° 25′ W., the rumbling sound as of distant thunder, so usual a forerunner, preceded this earthquake, and almost immediately the rocking motion of the earth commenced. Houses trembled with increasing force, until they fell in crashing ruin. The earth opened in several places in almost regular clefts from one to three inches wide, and as these closed they sent a cloud of dust to mingle with that from the falling buildings. Gas of a most suffocating nature, came from these fissures, and had it remained long, all animal life must have perished, but after three undulations, each severer than the preceding one, the cloud of dust and gas which overhung all, dispersed, and the light again appeared. The gas remained in all about a minute and a half. Quakes at short intervals succeeded, and subterranean explosions, and now all the survivors fled to the hills, taking their most precious property, for the sea was fast receding, and they well knew the terrible consequences of that unnatural tide. Soon the current changed, the ocean came back in a huge wall of water, dragging with it all the vessels, among them the large U. S. steamer Wateree

which was landed almost uninjured about four hundred and fifty yards inland. The other vessels did not fare so well: dashed ashore, keel upmost, they remain a sad spectacle, the prey of the wreckers. On shore less than a hundred people lost their life, while on shipboard nearly three hundred perished. At Iquique the shock lasted over four minutes, and was followed by the wave which destroyed at least three-quarters of the town and many lives. At Arequipa the earthquake commenced a few minutes past five in the afternoon, and in a few moments nearly every house in the town was in ruins. The cities of Yca and Pisco suffered severely, and at the Chincha Islands both the earthquake and the tidal wave did great damage. At Callao the wave went over the houses on the shore at 10 o'clock, P. M. These were much damaged, but no lives were lost. At Talcahuano, and Torne, near Conception, three shocks occurred, a day later according to the reports, and the second caused, or was followed by a tidal wave, which nearly destroyed the towns. From Cape San Francisco, in Ecuador, to the Straits of Magellan, nearly every seaport town has suffered, and at the northern end of this coast line, among the mighty volcanoes of the equator, the records report several towns in ruins, among them Ibarra, San Pablo, and Atuntaque, and where Catacachi stood is now a lake of water. No less than thirty thousand inhabitants of these towns perished with their homes.

Let us close this sad catalogue of disasters, where man seems so utterly powerless to cope with the vast forces with which God's plan of creation is carried on, with a brief review of some of the former earthquakes, which have rendered this region so noted.

According to Ulloa, in 1570, along the coast of Chili, an earthquake and tidal wave was felt which extended three hundred leagues along the coast. In 1575 Valdivia was destroyed. January 22d, 1582, at noon, Arequipa was destroyed, and four years later, at Callao, a tidal wave four-

teen fathoms high followed a severe quake, and extended two leagues inland. In 1600, Arequipa was covered with ashes from a neighboring volcano. In 1605, November 26th, Arequipa was destroyed, and the sea overwhelmed Arica, leaving a few streets only. In 1678, at Santa, some 5° N. of Callao, the sea retired a long distance, returning with great force, and destroyed the town. Four years later Pisco was destroyed by a tidal wave. Six years rest, and Pisco was again inundated, and in 1690, after a very violent shock, the sea retired six miles, and after three hours returned with such rapidity that the fleetest horses could not save their riders; the earth sank, and where the town stood is the present harbor. In 1705, Arica was destroyed by a tidal wave, and ten years later was nearly overturned with Arequipa and other towns by earthquakes. The next year, 1716, the town of Pisco, which had been rebuilt farther inland, was again destroyed, and now not by a tidal wave, for although the sea was so agitated that masts and yards of vessels were shattered, it did not pass its bounds. July 8th, 1730, Conception was destroyed by an earthquake and tidal wave. At Callao in 1746, a severe earthquake was felt, and the tidal waves were of great size; of twenty-three vessels then in port, seventeen were sunk, and four carried inland above the town, which was levelled by the waves. Of four or five thousand inhabitants, only two hundred survived, and on the second advance of this vast wave, only a portion of the wall of the fort, which preserved twenty-two persons, remained. In 1773, at Copiapo and along the coast, the earthquake claimed 45,000 victims. May 15th, 1784, Arequipa was overturned, and several districts hitherto arid, produced springs of water, so abundant as to form navigable streams. In 1828, at Callao, an English vessel, the Volage, found the water boiling about her, and exhaling a great quantity of sulphuretted hydrogen. Many dead fish floated; on weighing anchor portions of the cable twenty-five fathoms from the ship, lying on a bottom of soft

mud, were found partly melted. Arica this time wholly escaped, although the shocks were felt all over Peru. In 1831, after nearly a century's rest from any fatal shocks, Arica was destroyed for the fifth or sixth time since the landing of the Spaniards, some three hundred years since. These are only the most severe shocks which have disturbed this region. Others, that anywhere else would attract attention, here pass almost unnoticed. Indeed it has been said that the Andes are continually quaking in some part, although severe shocks have seldom visited the eastern slope.

The volcanoes nearest the cities of Arica and Arequipa are of great height; *Sahama*, near the former, being 23,914 feet, while *Miste*, near the latter, is 18,877 feet high, and frequently in gentle eruption.

With such an array of terrible results, it would be hard here to insist, with any chance of being believed, that earthquakes are, by no means, nuisances, and, that on the contrary, they are portions of God's operations in Nature most beneficial and useful. The tides of the ocean are useful, that every one knows, although they leave bare and pestilent marshes and flats; and these irregular tides of the land have none the less their uses in breaking up and altering the surface of the earth, changing watercourses, altering the shore-line, and in other ways, whose description can hardly be condensed into the limits of this article.

REVIEWS.

THE VARIATION OF ANIMALS AND PLANTS UNDER DOMESTICATION.*—These volumes are the first of the suite promised by the author in his work on the "Origin of Species," and are filled with facts of his own observa-

*The Variation of Animals and Plants under Domestication. By Charles Darwin. Authorized (American) Edition, with a Preface by Professor Asa Gray. 2 vols, 12mo, pp. 494 and 500. Published by Orange Judd & Co., 245 Broadway, New York.

tion, and extensive quotations from all the authorities upon the various races of domesticated animals. The author's general argument may be inadequately given as follows: That since "all organic beings increase at so high a ratio, that no district, no station, not even the whole surface of the land or the whole ocean, would hold the progeny of a single pair after a certain number of generations," "the inevitable result is an ever-recurrent struggle for existence." In other words, a contest for growing and feeding room in which "the strongest ultimately prevail, the weakest fail." "If, then, organic beings in a state of nature, vary even in a slight degree," "the severe and often-recurrent struggle for existence will determine that those variations, however slight, which are favorable, shall be preserved or selected, and those which are unfavorable shall be destroyed." Thus if by any chance a male is born stronger than his fellows, he will prevail in the battles of the breeding season, and raise offspring having a certain advantage, also, over their fellows in point of strength, and thus this variation will gradually accumulate until the peculiarity which distinguished only one individual, becomes common over large areas, and perhaps universal to the species.

Again if an individual vary in any way which may give it a better chance of surviving in the general struggle, this variation is likely to become permanent, since a greater number of this favored race would survive and transmit their peculiarities to their offspring. Thus a constant progress is maintained, the structures varying and gradually departing from their original types by this infinitely slow process of improvement by evolution, until new species, new genera, and new families arise. This process is called natural selection, showing that nature does her work of progressive improvement in organic beings, as the breeder does among domesticated animals, by the destruction or exclusion of the inferior individuals, and the pairing together only of the strongest and best.

Darwin's opponents say on the other hand, that a species is an invariable type, and that the variation of individuals does not accumulate, but fluctuates between certain limits. The inevitable conclusion being that there is no progress by the evolution of one form out of another, but that each species is a creation directly from the hands of God.

The anti-Darwinists lay great stress upon the tendency of cultivated plants and animals, especially when allowed to run wild, to revert, in their characteristic markings, to the original wild types. We are disappointed that so little is said upon this point in the volumes under review. Unquestionably the doctrine of reversion bears two interpretations in the present state of our knowledge, according as one considers it subordinate or more powerful than the tendency to variation. The anti-Darwinist takes the last view, and attributes the different races of domestic animals, with their great anatomical differences, to the power exercised by man in rendering tendency to reversion powerless while he increases the tendency to variation; thus artificially sustaining and producing races which could not have occurred under the action of natural

laws, since among wild animals the two tendencies would mutually counteract each other, keeping the species within its own proper boundaries of form and variation.

The only really notable instance about which the author seems to entertain no doubt, is the Porto Santo rabbit. This animal, though differently marked in some respects, and not more than half the weight of the English rabbit, yet recovered the peculiar markings of the English species in rather less than four years after its transportation to England. Thus in a feral state, under a different climate, it lost the characteristic colors and weight of its species, and returned to the colors only when brought to its native climate. They were found while in the Zoölogical Gardens to be extremely wild and active, more like large rats in this respect than rabbits, and untamable; and the two males, though bachelors, utterly refused to pair with the native breeds; "yet this rabbit, which there can be little doubt would thus have been ranked as a distinct species, has certainly originated since the year 1420."

One would think that an instance of this kind would unquestionably prove the efficiency of change of climate, and the external surroundings of the species in producing a revolution in its characteristics. Natural selection could have had nothing to do with the return of the characteristic markings of the species after its return to England, since they were the same individuals, and not their offspring, which reverted. Yet, Darwin (p. 337) is disposed to attribute the change which took place when the species was transported to Porto Santo, rather as due to reversion and natural selection, than to change of climate. If so, why did change of climate produce the reversion to its ancestral colors when it was transported to England, and why is the hot insular climate of Porto Santo deemed inadequate to produce a similar result? A cause similar to that which produced the change of color in so short a time, would certainly seem adequate to produce the change of size and habit in the time which elapsed since the year 1420.

The proposition that the laws which govern the propagation and inheritance of characteristics among domesticated races, are the same as those which obtain among wild animals, is supported by a classification of the pigeons, in which the several stocks are traced back through intermediate types to Columba livia. The author, also, adds that in this classification "the same difficulties are encountered and the same rules have to be followed as in the classification of any natural but difficult group of organic beings." The novelty of the fact, however, consists in this, that the several races, the Pouter, Fantail, Carrier, etc., differing from each other to an extent which only those who have seen them can appreciate, are traced, with more or less probability, back to one common ancestor. Perhaps none of Darwin's experiments and researches will excite the attention of the systematic zoölogist more than this. That man has been unable to destroy the laws of affinity as they exist among natural groups, while he has so radically modified the form and character of the original species, is a significant fact. If true, we can no longer assert that man

can reverse or denaturalize the action of these laws among domesticated animals, but simply change the direction of their action. Thus he may make them produce any given series of forms which are possible in the organization of the progenitor, but all these forms will be related to each other, and must be classified in the same way as a natural series of feral animals.

In the second volume, after showing that inheritance of structure and habits must be considered the rule, except when "overborne by hostile conditions of life, by incessantly recurring variability and by reversion," the author states this very important law. "At whatever period of life a new character first appears, it generally remains latent in the offspring until a corresponding age is attained, and then it is developed. When this rule fails, the child generally exhibits the character at an earlier period than the parent. On this principle of inheritance at corresponding periods, we can understand how it is that most animals display from the germ to maturity such a marvellous succession of characters."

Naturalists universally acknowledge that, during their development, animals pass through certain changes or stages of growth, during which they acquire characteristics resembling the peculiarities of the adults of more simply organized species. This law has hitherto only been ascertained in the larger groups in a general way, or if applied to smaller groups has been used only to settle disputed points of classification. In an article recently published, Mr. Hyatt has applied this embryological law to the classification of the fossil Ammonoids, even to species of closely allied genera.*

His observations, however, differ, having been made upon species instead of individuals, in this important particular: namely, that which is accidental with the immediate offspring, the earlier appearance of a new characteristic, is the law and not the exception between the species, and in some quite closely allied shells, such as *Androgynoceras hybridum. A. appressum*, *Liparoceras Henleyi*, and *L. Beechei*, certain characteristics are developed at earlier periods in each succeeding species of the series, and finally omitted altogether. This and similar instances led him to the conclusion that "the young of higher species are constantly accelerating their development, and reducing to a more and more embryonic condition, or passing entirely over the stages of growth corresponding to the adult periods of preceding or lower species." We should look, therefore, upon this earlier occurrence of characteristics, among individuals, not as an accident, but as probably a law. Without it we cannot see how any room, on the basis of Darwin's theories, can be obtained in the life of any individual or species, for bringing to maturity those characteristics which especially mark it as an advance in the line of progress.

To account for the various phenomena of the inheritance of character, features, diseases, and injuries at corresponding ages in the offspring, and reversions, we have the doctrine of Pangenesis.

* Memoirs of the Boston Society of Natural History. Vol. I, Part II. On the Parallelism of the Individual and Order in Tetrabranchiate Cephalopods. By A. Hyatt.

According to this theory, each cell in every part of an animal is supposed to be capable of throwing off an infinite number of gemmules, or organic units, at every stage of its development. These gemmules are conveyed from the parents to the embryo through the medium of the sperm and ovule. In this way the development of characteristics, at corresponding ages, is readily accounted for. These gemmules are capable only of producing cells like those from which they were derived, and thus they continue to live in the circulation until the proper age for their development into cells enables them to join in building up the body. They would then be drawn together, as we understand it, by a sort of natural affinity, and reproduce the tissues of the part from which they were derived. Under adverse circumstances, certain classes of these would not be developed but lie dormant in the organization, though still transmitted from parent to child, until in some remote individual they would find the proper opportunity for development, and produce a reversion. While this theory appears to satisfy nearly all the conditions of inheritance, there are certain cases which Mr. Darwin, with his usual candor, admits are inexplicable. Those instances in which certain varieties of plants can be propagated by buds, but revert in the seedling, this occurring especially with hybrids, and "certain plants with variegated leaves, phloxes with striped flowers, barberries with seedless fruit, can all be securely propagated by the buds or cuttings; but the buds developed from the roots of these cuttings almost invariably lose their character, and revert to their former condition."

It is the misfortune of a science in the transition stage of its history that all theories can only be approximations to the truth. The old and the new theories of life are no exceptions to this rule, and the minds of naturalists are distracted by two views, apparently equally uncertain. Darwin, with all his erudition and extensive research, is unable to remove the main difficulty in the way of the doctrine of evolution. He is obliged, in his "Origin of Species," to assume the miraculous creation of four primary types, and only by analogy does he consider himself justified in referring these four types back to one common ancestor. This part of the argument he candidly confesses is weak and unreliable. Darwin, also, wisely avoids any reference to the origin of life itself, and when he has arrived at the four primary types, and even by analogy at their single progenitor, the reader is still as far as ever from knowing where and how they came into being.

As yet, all attempts to produce living beings, of even the lowest organization, from inorganic compounds have failed, and in all cases where spontaneous generation is said to have occurred, the Bacteriums, Monads, etc., have appeared in a fluid which was impregnated with some vitalized compound.* Life is not necessarily extinguished by the heat to which these fluids were subjected, or else why is it that cooked food, which has been subjected to any heat short of absolute combustion, is capable of convey-

*A Word on the Origin of Life. By Professor J. D. Dana. Silliman's Journal, May 1866.

ing more or less of its former store of vitalized matter into the digestive organs? These experiments, however, do not justify the unbiassed mind in coming to any conclusion. They have been made with great care and thoroughness, but until a series of similar attempts, with all the modern appliances and safeguards, has been tried upon matter which is not derived in any way from previously vitalized compounds, it is not safe to say either that life can or cannot be produced by spontaneous generation. The key-note to the theory of the origin of species, the doctrine of evolution, would appear to be the origin of life, the beginning of evolution, and this theory, however true it may be in its minor applications, is very far from completion when it rests upon a basis of four primary types, or even one whose origin is doubtful.

On the other hand, the theory of miraculous creation, by which it is believed that every species is separately created, rests upon negative evidence. It is alleged that the ancestry of no one species has as yet been traced to a specifically distinct progenitor, and that the same species do not usually cross any of the great gaps in geological time, thus giving to each set of beings, which successively inhabited the surface of the earth, the appearance of a new, independent creation.

These two, grand, negative arguments, are the buttresses of the theory, but it is hardly necessary to say that they are not conclusive. The basis they afford is liable to be shifted by any new investigation, since it is not inherently improbable that species may have specifically distinct progenitors, or that they pass from one geological formation to the other, but only the first has not been traced, and the last is still a disputed question.

To complete the elements of confusion and uncertainty, we have no fixed meaning to the word species, which is the key-note to the dispute. While all know that a naturalist means a certain initial division, all the members of which are *supposed* to be, on account of their resemblance to each other, the descendants of a common ancestor, there is no test of this consanguinity. It thus becomes in practice a matter of personal judgment, whether we select a larger or a smaller initial division, and call it a species, though it makes a vast difference in the result. If we regard slight differences as sufficient to characterize the species, we are drawn towards the view that each is separately created; if, however, greater latitude is given, the varying forms thus supposed to have a common ancestry are strong supporters of Darwin, and his laws of inherited variability. It is, perhaps, this uncertainty, and the desire of almost all minds of the nineteenth century, to look for secondary causes, whose modes of action may be determined by experiment, rather than to refer to the direct interposition of the Creator, that has caused so many converts to Darwinism.

The present volumes are, besides their value to the philosophical naturalist, a condensed statement of facts with regard to domesticated animals, and bring the agriculturist and zoölogist face to face in a way which we cannot but hope wlll prove beneficial to both. Whatever may be the errors of theory, the facts are judiciously classified, faithfully and can-

didly given, both for and against the author's opinions, and cannot but prove of great value to every unprejudiced reader.

In conclusion we may remark that no fear of scientific technicalities need deter any one from procuring these volumes. They convey a vast amount of instruction in a thoroughly comprehensible garb.

FIELD, FOREST, AND GARDEN BOTANY.* — We are glad to be able to announce the approaching issue (if not already in the market) of a work upon botany, of a character so likely to meet the wants of amateurs, whether botanists or gardeners, as well as of those who make either botany or gardening a profession, and indeed of every one who likes to know the name of a common plant of our region, either wild or cultivated. It is a book from which everything is left out that is not directly conducive to the easy determination of the name of a plant we may happen to have in hand, and one in which all reasonable facilities, in the way of copious Analytical Keys, Index, and typographical arrangement are introduced for this very purpose. Although 2,650 species, under 947 genera are described with more or less of detail, yet those who use this book must not be disappointed if they do not find the rarer native plants mentioned. They must turn to the "Manual" for those, and it would be unreasonable to suppose that every plant from foreign parts, which we may cultivate, is described in a book of less than 400 pages. As already intimated, however, all our common wild plants which are worthy of notice, and all the more generally cultivated garden and hot-house plants, are here described in terms, from which, so far as it is possible, all technicalities are eliminated, and all synonymy is left out.

A special advantage that the book offers is, that it will enable students and teachers of botany to use in their study and teaching, exotic plants which will often present forms of structure that are not represented at all in our fields and woods, or even introduce the knowledge of whole natural orders, which are otherwise beyond their reach, without recourse to extensive botanical libraries. The use of this book will also enable the study to be carried on in winter with much greater facility than ever before.

Another feature of the work will be very acceptable to many persons, and that is the part concerning the ferns, contributed by Professor Eaton of Yale College. All our common native ferns, as well as those usually cultivated, are described so as to be easily determined by any one who is familiar with the meanings of the few technical terms necessarily used, and who reads with care the characters of the Natural Order.

As the author says in his Preface, "the great difficulties of the undertaking have been to keep the book within the proper compass, by a rigid exclusion of all extraneous and unnecessary matter, and to deter-

*Field, Forest, and Garden Botany; a simple introduction to the common plants of the United States, east of the Mississippi, both wild and cultivated. By Asa Gray, Fisher Professor of Natural History in Harvard University. New York: Ivison, Phinney, Blakeman & Co. Chicago: S. C. Griggs & Co. 1868. (Reviewed from advance sheets.)

mine what plants, both native and exotic, are common enough to demand a place in it, or so uncommon that they may be omitted." Should it be found that the descriptions of more cultivated plants are wanted by those who use the book, we are half promised that "if the book answers its purpose reasonably well, its shortcomings, as regards them, may be made up hereafter."—H. M.

Annual Report of the Trustees of the Museum of Comparative Zoölogy.*—By the present report it appears that this Museum, with its great store of specimens, requires to be enlarged in order to become useful to the public, and also requires that the annual income of $10,000 should be about doubled in order to carry on the work of publishing, and the internal arrangement of the collections. We hope that the grant of the Legislature, during their last session, will more than supply this want. The director presses upon the trustees the claims of scientists to a partial use of the collections, which in their present state are not available to investigators. The work done this year seems to have been wholly for the preservation of the collections, with the exception of Dr. Wilder's dissections of the Selachians, and Mr. Leo Lesquereux's labors on the Fossil Plants. Dr. Hagen, although at work in the Museum, seems to have contributed nothing to the present Report. We quote from Mr. Lesquereux's report the following remarks on American Fossil Botany:

"The few vegetable remains, for example, obtained from the Tertiary of Tennessee and of Mississippi, and from the Cretacean formation of Nebraska and California, have demonstrated facts, which science was scarcely prepared to admit:

"First. That the floras of our ancient formations already had peculiar types, which separated them from each other in the different continents. This is even evident in the vegetation of the Coal measures. Therefore, the supposition of a continental union of Europe with America by Atlantides or other intermediate lands, is proved to be untenable.

"Second. That the essential types of the old floras, of the cretaceous and tertiary formations have passed into our present vegetation, or are preserved to our time. The Cretacean of America, for example, has already the Magnolias, which we find still more abundant in our Tertiary. This last formation has furnished a number of species of the genus Magnolia, nearly identical with that now existing in the United States, while the genus is totally absent in the corresponding floras of Europe. More than this: we find in our Tertiary the same predominating types marked on both sides of the Rocky Mountains. On the Atlantic slope, leaves of magnolias, of oaks, of elms, of maples and poplars, and not a trace of coniferous trees; while in California and Vancouver Island, the red woods or Sequoia, abound in the Cretacean and Tertiary, as now they still form the predominant vegetation of the country. These few facts are mentioned only to show the importance of collections of fossil plants from every formation of our American continent, the only part of the world where questions of general significance concerning palæontological distribution can be studied with some chances of satisfactory conclusions."

Natural History of Birds.†—There is at present great need of an elementary work on Ornithology, treating of the general principles of the science, written in popular language, and adapted to the wants of learners. The preparation of such a work seems to be the design of the authoress of "Lectures on Ornithology," Part I. of which we have already received.

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*Annual Report of the Trustees of the Museum of Comparative Zoology. Report of the Director, 1867. 8vo, pp. 22.

†Natural History of Birds. Lectures on Ornithology. In ten parts. By Grace Anna Lewis. Philadelphia: J. A. Bancroft & Co. Part I. 12mo, pp. 32. 1868.

This treats of general principles, and is to be understood as being introductory, while the remaining parts will be devoted to the structure and further classification of birds; their general habits and instincts; the relations of their *habitat* or residence to physical causes, and to their geographical distribution; to which is to be added "a briefly descriptive catalogue of the birds of the Middle States," and "of many of the most beautiful or remarkable birds of the world." It is designed, also, to devote special attention to the structure and exquisite colors of the plumage, and the microscopic character of the downy covering of the young; a field of research as yet hardly approached, yet full of interest, and of practical value to science.

In this first part the writer very appropriately devotes several pages to an account of the structure of the egg, and the mode of development of life within it, and subsequently notices the differences noticed in the external form of the egg as seen in the different groups, and the peculiar variations in the color and texture of the shell. The greater part, however, is devoted to a discussion of the classification of birds; a new or considerably modified system of which is proposed. It shows that the writer has given the subject considerable thought, and is in many points highly commendable, in fact approaching in general more nearly to the natural system, than several of the classifications recently proposed by our (reputed) highest authorities. We scarcely see the propriety, however, of making a third sub-class of the Ostrich and the Dodo, and their respective allies, nor of dispersing the Prœcoces so widely among the Altrices, as is done, not only in the present case but generally. The subdivision, by Oken (according to Agassiz, by Bonaparte as generally received), of birds into two grand divisions, be they sub-classes or orders, seems to have been a truthful and important recognition of two very natural groups, the subsequent mingling of which seems only to tend to prolong confusion. The parallelisms between the two groups pointed out by Professor Dana, or the occurrence of representative groups in each, seems strongly to corroborate their naturalness.

Miss Lewis's modestly written book, however, seems likely to supply a gap in our ornithological literature, and as it bears unmistakable marks of originality, and promises a clearly expressed epitome of the present state of the science, we heartily commend it as a work fully entitled to generous patronage.* — J. A. A.

REVIEW OF THE SCANDINAVIAN PUBLICATIONS IN NATURAL HISTORY DURING 1867 AND PART OF 1868.† (In a letter from Dr. Lütken of Copen-

*The Naturalist's Book Agency will supply this work at 35 cents a part.

†Dr. C. F. Lütken, an accomplished naturalist and assistant in the Royal Zoological Museum, at Copenhagen, has kindly consented to prepare for the NATURALIST, a yearly review of the progress of Natural History in Scandinavia, of which the following interesting report, to be concluded in the next number, relates to the literature of Denmark and Norway. The conclusion, embracing Sweden and Finland, will follow soon. As these works are rare and generally inaccessible, containing papers by the most thorough and reliable observers in Northern Europe, we think the readers of the NATURALIST are especially fortunate in securing such reports from the fountain head of natural science in Northern Europe. — EDS.

hagen, dated October 1, 1868.)—According to your request, I have the honor of laying before your readers a short summary of the latest scientific contributions of Scandinavian naturalists, to the progress of those departments of science to which your esteemed journal is devoted; but the limited space likely to be allowed to such a review will permit my giving little more than the titles of the papers. Nevertheless, I entertain the hope that it will be sufficient to show that the part taken by Scandinavian naturalists in the common work of the advancement of science, is important enough to justify the increasing attention bestowed upon this branch of scientific literature in later times abroad, especially in England and America; and I may be permitted to add, that nowhere ought the Scandinavian literature be better known. The Scandinavian tongues, and especially the Danish, enter so largely into the composition of the English language, that it must be a comparatively easy task for an American to make himself so far familiar with our language, that their rich literary treasures may not be unintelligible mysteries to him.

Permit me to begin with the scientific productions of my own country, with which I am of course best acquainted. Of papers falling within the limits of this review, the *Oversigt over det Kongelige danske videnskabener Selskabs Forhandlinger*, for 1866 and 1867 (Proceedings of the Royal Danish Academy of Science), contain the following: First, a critical essay from the pen of the Secretary (Professor Steenstrup), "On some of the more important results of the diggings made in the French bone-caves during late years," containing many important suggestions, but perhaps most worthy of serious attention by its opposing strongly some commonly diffused notions about the supposed contemporaneity of man and certain extinct animals, *as an established fact*. The author will only yield to positive material evidence of man's existence at a given epoch, deduced from his treatment in definite manner of the bones of the animals hunted, or from his having made unquestionable and authentic figures of them; and such arguments are as yet almost absolutely wanting; the "bare evidences" are rejected as utterly useless in this respect. Professor Reinhardt has described and figured (on two plates) three new species of *Characinoids* from Lagoa Santa, Brazil (*Piabina*, new genus, *argentea* Reinh., *Characidium*, new genus, *fasciatum* Reinh., and *Parodon Hilarii* Reinh.). In the French "resumé," attached to this paper (as in fact to almost all the papers of the "Proceedings," for the purpose of making them more intelligible to foreigners), the author adds some interesting remarks on the geographical distribution of the Brazilian freshwater fishes. Mr. Reinhardt has brought home from the Rio San Francisco, but especially from its tributary, the Rio das Velhar (Minas Geraes), twenty-five species of *Siluroids*, twenty-six of *Characinoids*, four of *Gymnotoids*, and two of *Sciænoids*. Fourteen other fishes have been described from the same water-basin by other naturalists, and four more were mentioned by the residents of the country, but remarkably enough, there is not a single *Chromid*, though the adjoining waters are richly stocked with species of this family. Professor Hannover has given an abstract of his

researches on "the microscopical structure and development of the dermal teeth (scales and spines) of the *Chondropterygii*." The memoir is printed in full in the Transactions of the Academy, and illustrated with four plates and some figures in the text. French resumés having been added both to the Memoir (at least to the copies separately printed), and to the paper in the "Proceedings," I shall confine myself to mentioning that the author has established four types of placoid dermal teeth according to the shape of the cells: the "conical" (dorsal spines of *Raja batis*), the "knoll-like" (scales of *Carcharias* and *Chiloscyllium*), the "net-shaped" (spines and scales of *Trygon*), and the "bundle-shaped" cell (*Pristis*). A chapter is added on the dental structure of the dermal plates of *Ostracion*, and a detailed description is given of some very enigmatical comb-like corneous bodies, preserved in the museums of Copenhagen, Christiana and Kiel, but of unknown origin: from their resemblance in microscopical structure to the dermal spines of skates, the author is inclined, I think, hardly with sufficient reason, to ascribe them in some way to this order of fishes.* Professor Johnstrup has discovered in the old Danish part of our neighbor-kingdom, at Annetorp, in the vicinity of Malmo, in Scania, a new locality for that remarkable limestone formation, termed the "Faxoe-limestone;" it is one of the youngest links of the Cretaceous formation in Scandinavia, and is extremely rich in fossils, being in fact a great fossil coral growth. At Annetorp the relations of this second deposit of Faxoe-limestone to the other stages of the Chalk formation are clearly indicated and have confirmed the position previously assigned to it. Professor Lange reviews the species of plants figured in the forty-sixth part of the "Flora Danica," and Professor Œrsted continues his curious experiments, demonstrating that certain fungi, parasitic on different species of plants, and described as distinct genera and species, are in reality only the *alternate generations of one species*. This he showed to be the case with *Podisoma Sabinæ* infesting the branches of the Savin, and *Rœstelia cancellata* (on the leaves of the pear), while *Podisoma clavariiforme*, residing on the branches of the juniper, manifests itself as the first asexual state (or generation) of the *Rœstelia penicillata* (lacuata), which gets its livelihood from the leaves of the apple and the white thorn; and *P. juniperinum*, inhabiting also the branches and leaves of the juniper, is in the like manner reduced to the corresponding form of the *Rœstelia cornifera* (cornuta), infesting the leaves of the Sorb (Mountain-ash). You will remember that the specific identity of *Puccinia graminis* and *Oidium berberidis* was in the like manner demonstrated some years ago through the almost contemporary experiments of De Bary and Œrsted, thus confirming the opinion for a long time fostered by farmers, but rejected as superstitious by most naturalists (Sir Joseph Banks excepted), on the obnoxious influence of the Barbary on the corn-fields.

*A few months since, Professor Baird placed in our hands a singular bony plate, received by him from Professor Jenks, the locality of which was unknown. From a microscopic section of this specimen we came to the conclusion that the plate must have belonged to some part of an unknown placoid fish; and from the slight description of Professor Hannover's specimen, we believe ours to be the same.—EDS.

During the last two years two volumes have been issued of the Transactions of the Royal Danish Academy of Science (Vols. VI. and VII). They contain the following memoirs: Professor Hannover's Observations on Encysted Helminths in the Frog (with two plates), and on the Structure and Evolution of Scales and Spines in the Cartilaginous Fishes (spoken of above); Professor Johnstrup's Monograph of the Manner of Formation of the Faxoe-limestone, and its later alterations; Dr. Krabber's Helminthological Researches in Denmark and Iceland, especially on the Echinococcus disease in the latter country; Dr. Bergh's Anatomical Contributions to the History of the Æolidiaceæ (with nine plates); Professor Œrsted's on a peculiar, hitherto unknown, manner of Evolution in certain Parasitic Mushrooms, especially on the genetic connection between the Podisoma of the Savin and the Rœstelia of the pear tree, and finally Dr. Gottscher's Monograph of the Hepatic Mosses of Mexico, described from the collection of the late Professor Liebmann. As most of these papers had been published separately before 1867, or have already been referred to above, it will be sufficient to direct the attention of botanists to the last-named voluminous memoir, by one of the first authorities on the subject. It is written in Latin, and illustrated by twenty plates, mostly representing species of Plagiochila. More than two hundred species of Hepaticæ were collected by Mr. Liebmann, and three-fourths of this number were new to science. In the Scientific Contributions from the Society of Natural History, for the years 1866 and 1867, you will also find various papers on Zoölogy and Botany. Dr. Krabbe forwarded two papers on Helminthology. In the first he treats of certain undeveloped nursing forms of Tænia, and their presumed corresponding mature species, namely, the so-termed *Gyporhynchus pusillus*, from the mucus of the intestine, and from the gall bladder of *Tinca*, in which the author has recognized the "nurses" respectively of *Tænia macroplos* (from *Ardea nycticorax*), and *T. corrylancristáta* (from *Ardea nivæa*). *T.* (cysticercus) *arionis* (limacis) is probably the immature condition of *T. multiformis* of the Stork; and the miniature tape-worm observed by Stein in the *Tenebrio molitor* is identical with the *Tænia murina* of rats and mice as first suggested by Küchenmeister.

In a second paper Dr. Krabbe has described and figured the tape-worms of the bustard, *T. villosa* Bl., and *Idiogenes otidis*. The latter new genus is especially distinguished by the peculiar wing-like dilatations of the sixth and seventh anterior segments (the head). Dr. Bergh has continued his researches on the anatomy and systematic distribution of the Gymnobranchiate and allied Mollusca by the description and anatomical investigation of two species of *Phidiana* (P. inca D'Orb., and P. lynceus, new spec.). The accessory eye discovered in the latter species occasioned a closer investigation, and a refutation of the presumed epipodial eyes in Margarita, described by Mr. Agassiz. The author also strongly combats the fecal theory of the urticating corpuscles in Æolidiaceæ. In another part of the paper he describes a parasitic Crustacean (Ismaila monstrosa) found on *Phidiana lynceus*, and allied to, or at least analogous, to

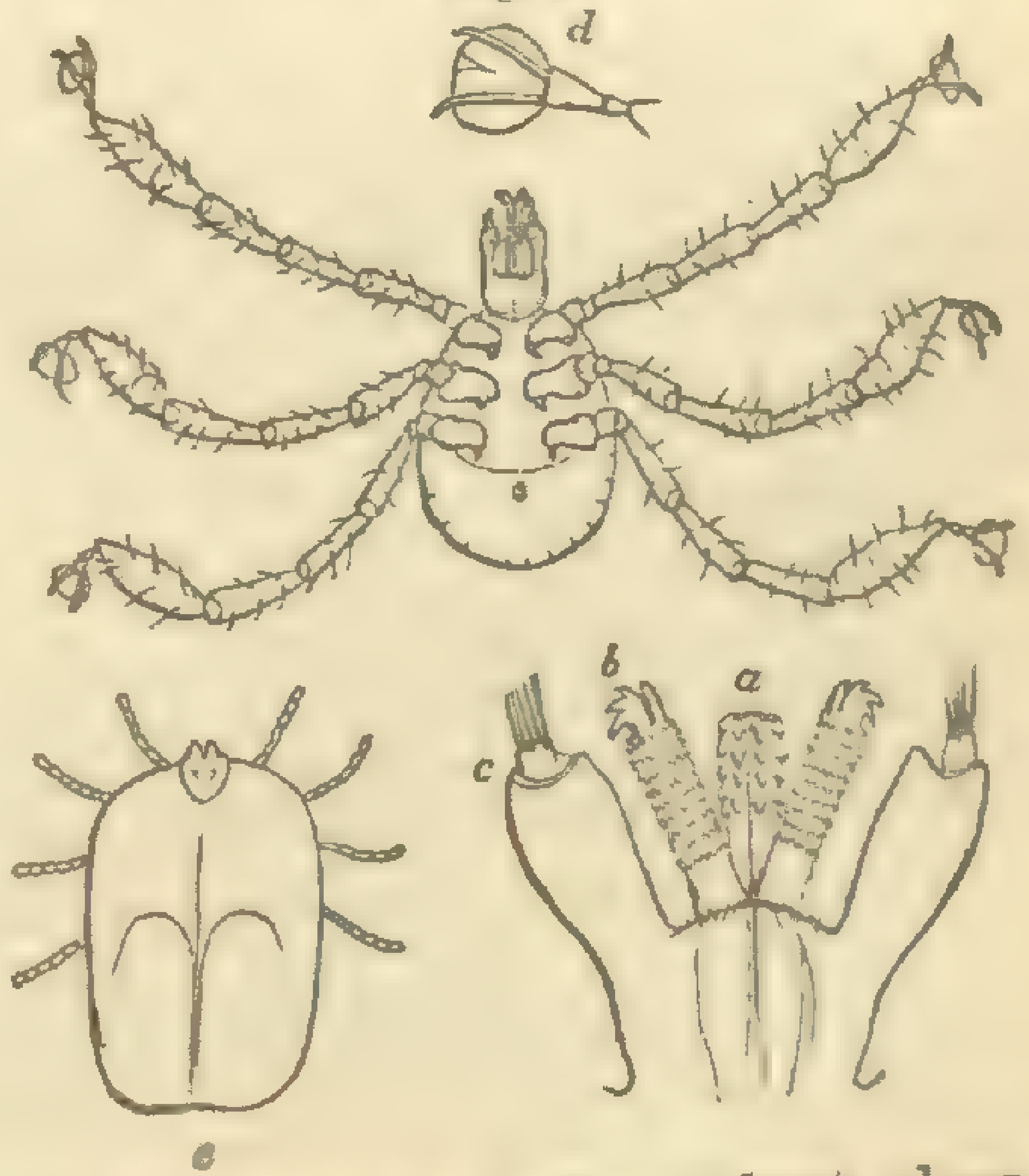
Splanchnostrophus. Some notes on the latter genus, and on an Acarus, parasitic on *Galvina rupium* are added. Mr. Mörch has given a detailed account of the Mollusca of the Faroe Islands (Cephalopods, three species: Brachiopods, one species; Gasteropods, sixty-five; and Bivalves, forty-two species), illustrated by an instructive tabular synopsis of the geographical distribution of the Mollusks of Iceland and Faroe.

NATURAL HISTORY MISCELLANY.

ZOÖLOGY.

THE MOOSE TICK.—On the 13th of April a pair of young moose were brought through New York on their way to Europe. They were raised in Nova Scotia, and being very tame, were allowed to run at large. The cow moose would ramble off in the woods, and while there, had become infested with ticks; the bull had escaped contact with these insects. When the cow arrived in New York, her sides and back were almost covered with adult ticks. The insects were removed very much to the relief of the animal, and the ticks were placed in a bottle without food or water. On the 1st of May they commenced to lay eggs, and continued to do so until the 25th of June, when they died. The eggs are forced out in large masses. On the 3d of July, the day after I sent the drawings to you, the entire mass of eggs seemed to hatch out at once, the shell opening like a clam, and releasing a six-legged insect.—W. J. HAYS.

Fig. 1.



[The specimens sent us by Mr. Hays are very interesting, as showing that the young tick has only three pair of legs instead of four, which all adult spiders and mites (*Arachnida*) possess. This is a strong argument for the supposition that the Arachnids form an order in the class of insects, and not an independent class. Fig. 1 *e* represents the adult tick, drawn by Mr. Hays. The six-footed young has enormous legs, and the head is separated from the hind body, where in the adult it is sunken in the thorax. *d*, shows the claws, with a broad sucking disk beneath, enabling it to adhere to objects. On the right is a magnified drawing of the mouth parts of the young; *a*, is the labium, armed with hooks; *b*, the maxillæ, probably, also armed with powerful hooks, and *c*, the mandibles. Thus armed, the young tick buries itself in the flesh of its victim.—EDS.]

EXCHANGES.

SHELLS.—I wish to exchange Land and Fluviatile Shells of the United States, with persons residing in other districts. Also, Marine Shells for Land and Fresh-water Shells.—H. FREEDLEY, *Norristown, Pa.*

LEPIDOPTERA.—The rarer species of Catocala (especially *C. relicta*) are desired in exchange for American Lepidoptera by JAMES ANGUS, *West Farms, N. Y.*

The rarer species of American Moths (especially *Geometridæ*), are desired by the MUSEUM OF THE PEABODY ACADEMY. Native and exotic insects will be sent in exchange.

TO LEPIDOPTERISTS.—I respectfully solicit from lepidopterists the use of any new and undescribed species of North American butterflies for publication in "The Butterflies of North America." Specimens will not be injured by the artists, and will be returned to the owners in as good order as received. Parcels sent to the care of J. H. Hunt, 52 Walnut Street, Cincinnati, O., will be duly forwarded to me. It will give me pleasure to name specimens of which any collector is in doubt, or to exchange. I especially desire to obtain, either by exchange or purchase, specimens from the far Western States and Territories or from British America.—W. H. EDWARDS, Post-office address, *Coalburgh, Kanawha Co., W. Va.*

ANSWERS TO CORRESPONDENTS.

S. J., Wyoming, Luzerne Co., Pa.—Your specimens came perfectly. They are fungi of the order of the Puff-balls, and belong to the genus *Geaster* Mich. The species we cannot determine at this moment, and it might require some study. The *Geasters* are rather rare,—Cooke reckoning but nine species found in Great Britain. They are closely allied to the common Puff-ball, but more curious and elegant in form. No use is known for them, nor are they supposed to be at all poisonous. It will be worth while to look for more.—C. M. T.

W. H. E., Coalburgh, West Va.—The phosphorescent larva enclosed is the young of Photuris Pensylvanica (see fig. 2, p. 432). It is our most common luminous larva, and we have identified it since the note on p. 432 was written.

H. S., Mt. Carroll, Ill.—The moth is a species of Depressaria. We should be much obliged to any of our readers for specimens of the cattle and horse ticks. They are to be found in the early part of summer, especially in the South-western States.

J. M. H., Kalamazoo, Wis.—During cloudy weather moths and butterflies secrete themselves during the day in grass and among leaves and similar hiding places. They are all very susceptible to the sunlight, and do not fly, as a general rule, in cloudy days.

W. C. F., Eastham, Mass.—Your fish is the rare little "One-spotted Dory," of Dr. Storer's Report (p. 78. pl. 14, fig. 2), *Argyreiosus unimaculatus* of Batchelder. Dr. Storer says that the only specimen he has seen was taken in Boston harbor, Oct. 1847. Mr. Batchelder's specimen was taken at Saco, Me. Your fish is of about the same size as the other two known specimens. Has your fish any eggs, or does it appear to be young?

W. W., East Windsor, Conn.—The larva is *Phobetrum pithecium*, one of the silk-worm family, though a very singular form.

H. H. K., Spencer, Mass.—For a brief notice of the froth-insect, which makes the "toad-spittle," see Vol. I. of the NATURALIST, p. 327.

W. H. K. L., Kansas City, Mo.—We return the insect, which is the *Belostoma Haldemanum* of Leidy.

BOOKS RECEIVED.

The Butterflies of North America; with colored drawings and descriptions. By W. H. Edwards. Philadelphia: Published by the American Entomological Society. Aug. 1868. 4to, with five plates. $2.00.

Hawaiian Club Papers. Boston, 1868. 8vo.

American Bee Journal. November. Washington.

Canadian Entomologist. Vol. I, No. 3. Toronto. 8vo.

Cosmos. October 3, 17. Paris.

American Entomologist. Vol. I, No. 3. St. Louis.

THE

AMERICAN NATURALIST.

Vol. II.—JANUARY, 1869.—No. 11.

THE SMALLER FUNGI.*

BY JOHN L. RUSSELL.

ALMOST everybody supposes that there can be no doubt as to what a toadstool, a mildew or a mould is, and some may even correctly call them fungi, if they are acquainted with the Latin word, which denotes them. Rust on grain, and smut on maize or Indian corn, are also familiar to farmers, but a multitude of other of the smaller fungi, are only known to the botanist. An accurate knowledge of them is to be found only with the mycologist, who as a botanist, devotes unceasing and strict attention to this particular department of natural history. Abroad it is to the researches of many eminent men and women on the continent and Great Britain, and in this country to several others both dead and living, that the structure, mode of growth, relation to the various departments of industry, injurious effects and general utility of these smaller fungi in nature, are collected and known.

As plants, though of a very low order of organization, the smaller fungi treated of in the work before us, are of great interest as mere objects of beauty. To attain a full comprehension of this fact, recourse must be had to the microscope,

*Rust, Smut, Mildew and Mould. An Introduction to the Study of Microscopic Fungi, by M. C. Cooke, with nearly 300 figures by J. E. Sowerby. London. 12mo, pp. 238, 1865.

Entered according to Act of Congress, in the year 1868, by the PEABODY ACADEMY OF SCIENCE, in the Clerk's Office of the District Court of the District of Massachusetts.

because the several portions of these structures are beyond the reach of the unaided vision. No one, who does not know, could possibly conceive that the little specks of brown or black seen on the brilliant and ripening foliage of the maples in September and October, (or to be seen on the skin of apples and pears, and many kinds besides on dry stalks of plants, on straw, on old decaying matter,) on the fence rails, on the panes of the window, on the bodies of diseased house-flies, on putrefying and decaying matter, are receptacles of exquisitely sculptured and carved seed-vessels, called *spores;* beaded thread-like strings of pearls; or of myriads of the most fantastic shapes that the genius of man in imitative or creative art has developed. A subject so broad, and one which can be investigated at any season of the year, inviting the botanist forth from earliest spring to latest autumn, to search for forms of beauty on every living or ripening leaf and fruit, and in winter rendering the evening lamp still more attractive in studying by its aid the collected treasures of the summer's gleanings, cannot but interest every thoughtful person in some way or other, if it should be presented in an agreeable manner, or with reference to the industrial pursuits of society.

Nor only to the general botanist, or even to the botanist whose speciality is the study of fungi, is this subject one of more than ordinary interest. Some slight acquaintance with a few of these wonderful little plants, would render the walk for exercise or pleasure ten times more valuable and remunerative. Who has not noticed so early in summer as some bright, sunny day in June, along the dusty roadside where the blackberry vines creep among the weeds and grass, their leaves powdered beneath with rich golden dust, shaken from little orange colored cups? And many is the enquiry from many a child, or even older person, that I would tell them what such a phenomenon were. The leaves of the barberry bushes too, with their extraneous adornments, when the fruit is tempting men and women, lads and maidens

alike, to the old stone-walls and rocky pastures; the leaves of the quince bushes in the garden; of the thorn bushes in the fields, how strangely distorted by curious forms. The wearied looking and dusty lilac bushes, so dusty at the end of summer that no rain can wash them clean, nor even will, so long as the egg-mould riots on the upper surfaces of their leaves; the crystalline drops of permanent dew glittering in the morning sun and which surmount many a tuft of equally crystal threads in countless numbers, issuing from some rejectamenta or waste matter; these and many, and more beside, often attract attention as we stroll or walk for exercise or pleasure, but are soon forgotten, because nothing is known of them; and who is there to tell? Cunningly, wisely, and full of a secret, hidden meaning, a thousand forms of the lower vegetable life, look up into the faces of pedestrians who, with repressed curiosity, and not quite willingly, tread them under foot. They are leaves of the great folio, marginal notes on the pages of the book of Nature, often and to many, and for a long period to every one, hieroglyphs whose deciphering would repay all the requisite toil. "How thankful I am to you," said a friend, "that you have told me so much about these beautiful, though dry and fragile lichens, which carpet the old pastures; they no longer can taunt me with their presuming pride, that they are something beyond my acquaintance." "The best lectures on botany," said the well-known educator, Geo. B. Emerson, once in conversation, "is after a plan persued by a friend, who in the fields discourses on the structural differences of whatever plant he meets." "Different kinds of plants, enough to occupy your life time, are now under my hand," said Linnæus, a hundred years ago, as the anecdote is told. What would the Swedish savant say now, when on the leaf of the elm alone, more than a dozen species of minute fungi are to be found? In a basket of wet mosses, lay through the night and part of the next day, a large agaric, with a few patches of a white mould attached, which, in that space of time, completely matted by its

rapid growth of intricate fibres, every surrounding object, revealing in the smallest bit of itself the forked branches and spores of a species of Peronospora with its two-formed fruit, any single one of which falling on the living tissue of moss germinated and bore fruit in turn! A few hours dampness and heat will develope the Botrytis and load its slender stalks with grape-like bunches of seed-bearing cells.

With an intention to introduce these little parasitical growths to the attention of the reading and thinking public, to such as would readily attend lectures illustrating such topics, and to make plain and easy, what at first seems so obscure and mysterious, the author commences by bringing forward some of the species most common in England, and explaining by words and by figures their form, structure and occurrence. We have only to change the words a little and designate the fields close to any large town or city of the United States, or at least of New England, to find the same or similar living plants, whose foliage or other parts of them are infested with the same species or with kinds closely allied.

"Amongst the six families into which fungi are divided, is one in which the spores are the principal feature. This family is named *Coniomycetes*, from two Greek words meaning 'dust fungi.' This family includes several smaller groups, termed orders, which are analogous to the natural orders of flowering plants. Without staying to enumerate the characteristics of these orders, we select one in which the spores are enclosed in a distinct *peridium*,* as in our typical plant they are contained within a sort of cup-like excrescence. This order is the Æcidiacei, so-called after Æcidium, the largest and most important of the genera included within this order. The Æcidiacei are always developed on living plants, sometimes on the flowers, fruit, leaf-stalks, or stems, but most commonly on the leaves, occasionally on the upper surface, but generally on the inferior. The different species

* *Peridium*, the covering of the seeds of fungi.

are distributed over a wide area; many are found in Europe and North America; some occur in Asia, Africa, and Australia." (pp. 5, 6.)

The Rev. Dr. M. A. Curtis, in his Catalogue of Plants of North Carolina, published at Raleigh, in 1867, furnishes us with as many as thirty species, to be found on the leaves of as many different living plants. Other lists in different parts of the United States give us still other species infesting other kinds of plants. Thus Schweinitz, in his "Synopsis of North American Fungi," mentions or else describes forty-one distinct species, which grow upon the leaves and other parts of native plants. From these let us select his *Æcidium ranunculacearum*, which attacks the foliage of various kinds of the buttercups, or Ranunculus. This fungus is likewise found in England, and listen to what our author writes about it:

"It is found on several species of Ranunculus, as *R. acris*, *bulbosus*, and *repens*. The leaf is thickened at the spot occupied by the parasite, and generally, without indication, on the opposite surface. Sometimes one spot, at others several, occur on the same leaf. The peridia are densely crowded together, often arranged in a circinate manner, *i.e.*, like a watch-spring. The seeds (spores) are orange, but slightly varying in tint on different species of Ranunculus."

The several species of Ranunculus here cited, though introduced plants, have become common in this country, and serve to enamel with golden blossoms our own meadows and fields. The swelling or excrescence upon the leaves, thus technically called peridium, as we have before noticed, splits at the top into many points or teeth, and renders it a pretty fringed cup filled with the yellow spores. On this account the Æcidiums are termed cluster-cups, the more so, especially when they are arranged in clusters upon the leaf. Of a species which in England infests the leaves of the "Goat's-beard" (*Tragopogon*), we are informed that "the spores in this species are orange, sub-globose, sometimes angular, and

indeed very variable both in size and form, though the majority are comparatively large. Each of these bodies is, doubtless, capable of reproducing its species, and if we compute 2,000 cluster-cups as occurring on each leaf, and we have found half as many more on an ordinary sized leaf, and suppose each cup to contain 250,000 spores, which again is below the actual number, then we have not less than five hundred millions of reproductive bodies on one leaf of the Goat's-beard to furnish a crop of parasites for the plants of the succeeding year. We must reckon by millions, and our figures and faculties fail in appreciating the myriads of spores which compose the orange dust produced upon one infected cluster of plants of Tragopogon. Nor is this all, for our number represents only the actual proto-spores which are contained within the cups; each of these, on germination, may produce not only one but many vegetative spores (sprouting buds), which are exceedingly minute, and individually may be regarded as embryos of a fresh crop of cluster-cups." (pp. 7, 8.)

The stems and leaves of the sweet violets, and of the several scentless ones beside, are distorted and ruined by other cluster-cups; the stinging nettle does not escape; the hardy dock, the useful currant, the wild geranium alike, feed with their juices other kinds, and a wide field of observation is offered to the lover of the microscope, to detect and discover other and yet unknown native sorts. However, "let us warn the young student against falling into the error of supposing, because the specific name of the fungus is derived from the plant it infests, that therefore the species differs with that of the plant, and that as a rule he may anticipate meeting with a distinct species of fungus on every distinct species of plant, or that the parasite which he encounters on the living leaves of any one plant is *necessarily* specifically distinct from those found on all other plants. The mycologist* will look to the specific differences in the parasite with-

* Mycologist, one who exclusively studies fungi.

out regard to the identity or distinctness of the plant upon which it is a parasite." (p. 6.)

It is an old and erroneous opinion which some of our farmers yet entertain, and which they have received by tradition from their ancestry, who brought it with them from the "old country," that the cluster-cups on the leaves of the barberry were capable of producing the blight and mildew upon grain, and that as an exemption from, or security against, such a fate, every barberry-bush should be effectually exterminated from the grain-fields, if, by careless husbandry or purposely for its fruit, it should be found bordering them. "This opinion," says our author, "even received the support of Sir Joseph Banks, but no fungi can be much more distinct than those found on grain crops, and this species on the leaves of the barberry.* In this instance the cups are elongated and cylindrical, and the spots on the upper surface of the leaf are reddish, bright, and distinct; the teeth on the edge of the cup are white and brittle, and the orange spores copious." (Fig. 1; *a*, leaf of barberry, with cluster-cups, *Æcidium berberidis*; *b*, a portion magnified; *c*, the same seen sidewise).

Fig. 1.

Very singular and curious clusters of excresences occur on the leaves of the apple tree, pear tree, and mountain-ash bush, and are very prominent on the leaves of the quince tree, and especially of the wild apple tree of the West, consisting of large peridia, pointed at the tops, and so swollen below as to bear a rude resemblance to urns, the edges split into

*This fungus and *Puccinia graminis* have been recently determined by Professor Œrsted to be one and the same plant. See Dr. Lütken's Review in the preceding number of the NATURALIST.

long and contorted threads. They are species of Rœstelia, the *R. lacerata* (Fig. 2; *a*, natural size, living on the leaves and fruit of the hawthorn; *b*, a portion magnified), *cancellata*, *mali*, *cornuta*, and of the *Centridium cydonia*, the spores of which are of a light orange color. The leaves of the pine and fir are sometimes attacked by the *Peridermium*, which in two species alters the foliage and spoils the effect of the branches. "In this genus the peridium bursts irregularly, and does not form cups or horns or fringed vessels." The *P. pini* has been frequently noticed in this country. The common houseleek is, in England, attacked by a parasitical fungus of this family, which burrows in the pulpy tissue of its thick and succulent leaves, and hence called *Endophyllum;* but I can find no notice of its occurrence with us. "We have derived much pleasure," says Mr. Cooke, "in viewing the astonishment and delight exhibited by friends to whom we have personally communicated specimens of the little fungi we have enumerated for examination under the microscope; and we recommend with confidence this group of parasitic plants, unfortunately so little known, as well worthy the attention of all who are interested in the minute aspects of nature, and who can recognize the hand

Fig. 2

> 'That sets a sun amidst the firmament,
> Or moulds a dewdrop, and lights up its gem.'" (p. 21.)

To which we can but add our hearty assent, and only wish that investigations and studies so prolific of gratification were more universal, especially among the young.

The spores of these smaller fungi have been spoken of as a sort of seeds by which the plants to which they belong are propagated. This, as we shall now see, is not strictly true,

and several novel and interesting points for consideration and even for enquiry arise. If we should place some of the yellow dust, which fills the cup-shaped peridia in a drop of water, and prevent its evaporation by covering it with a bell-glass, a tumbler or wine-glass would do as well, we should find, in a few hours, that each particle of the dust had swollen, and bursting at some point, had given out a blunt thread, at the apex of which, it is crowned with delicate curved appendages, which soon become connected by lateral threads, thus forming a kind of latticed net-work, and from the sides of these filaments little oblong cells sprout, which in turn germinate and reproduce the plant. For this highly interesting discovery we are indebted to the Rev. M. J. Berkeley of England, and a particular and extended account of which may be found in the London Journal of Horticulture, vol. 2, p. 107. Those of our readers, who are familiar with the early stages of the ferns can trace a striking analogy in the process.

In many of the smaller fungi, the first condition of the germinating spore, viz.: the cluster of curved and delicate appendages surmounting a thread, is present in another form, and constitutes what is termed the *Spermogone*,* often in the shape of a minute dot near the peridium and sometimes on the opposite surface of the leaf, and in fact a conceptacle or blister filled with threads, and throwing off from the apices the curved bodies, called *spermatia*, which escaped through an orifice provided for the purpose. Before the nature and office of these singular objects were known, spermogones were mistaken for distinct kinds of fungi, and many diverse species were described. They are, however, not wholly confined to the fungi, but even the lichens are furnished with similar ones. The size of the largest spermatia, those of the *Peridermium pini*, "have a length equal to $\frac{1}{5200}$ of an inch, but their width seldom exceed $\frac{1}{100000}$ of an inch,

* *Spermogones*,—pustules and depressions like pockets, containing *Spermatia* or germinating filaments.

whilst on others their length does not exceed the width of those just named." (p. 25.)

The evident effort of nature, then, in this process, is to produce an ultimate condition of fungal life, which shall be sure to continue indefinitely the presence of the parasites upon the leaves and other parts of the higher plants. And this is done by the *mycelium*,* a system of the most subtle threads which can enter the tissues by attacking the seed when sown, and whose persistence of vitality enables it to endure the most trying circumstances unharmed. So vitalized indeed is the mycelium, that any fragment of it will vegetate and grow after long periods of desiccation. And its luxuriance of growth is in nowise dependent on any higher development, such as, were it the stems and leaves of a flowering plant, would sooner or later push forth blossoms and fruit.

This vitality is taken advantage of in the cultivation of the edible fungi, such as the mushroom for example, where lumps of dried earth, permeated by the mycelium or "spawn," as it is technically called, are planted in prepared soil, and a profitable crop realized. It is also familiar to cultivators, that fruit trees and ornamental trees often languish and die, owing to their roots reaching spots deep in the ground where decayed wood, filled with the "spawn" of some destructive fungus exists. Fortunately the awakening to active life, and to injurious growth, seems to depend on causes which do not always exist, such as atmospherical and similar conditions, else there were no chance of security from these annual scourges of agricultural industry. Fungi of every kind are therefore regarded as meteorological phenomena; like a few of the higher plants, which appear at wide intervals, and then, sparsely.—*To be concluded.*

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* *Mycelium*, the fibrous portion of fungi, which grows underground or in the tissues of the plants upon which they are growing, and sometimes under the bark of living or dead plants.

BIRD'S-EYE VIEWS.

BY DR. ELLIOTT COUES, U. S. A.

(Concluded from page 513.)

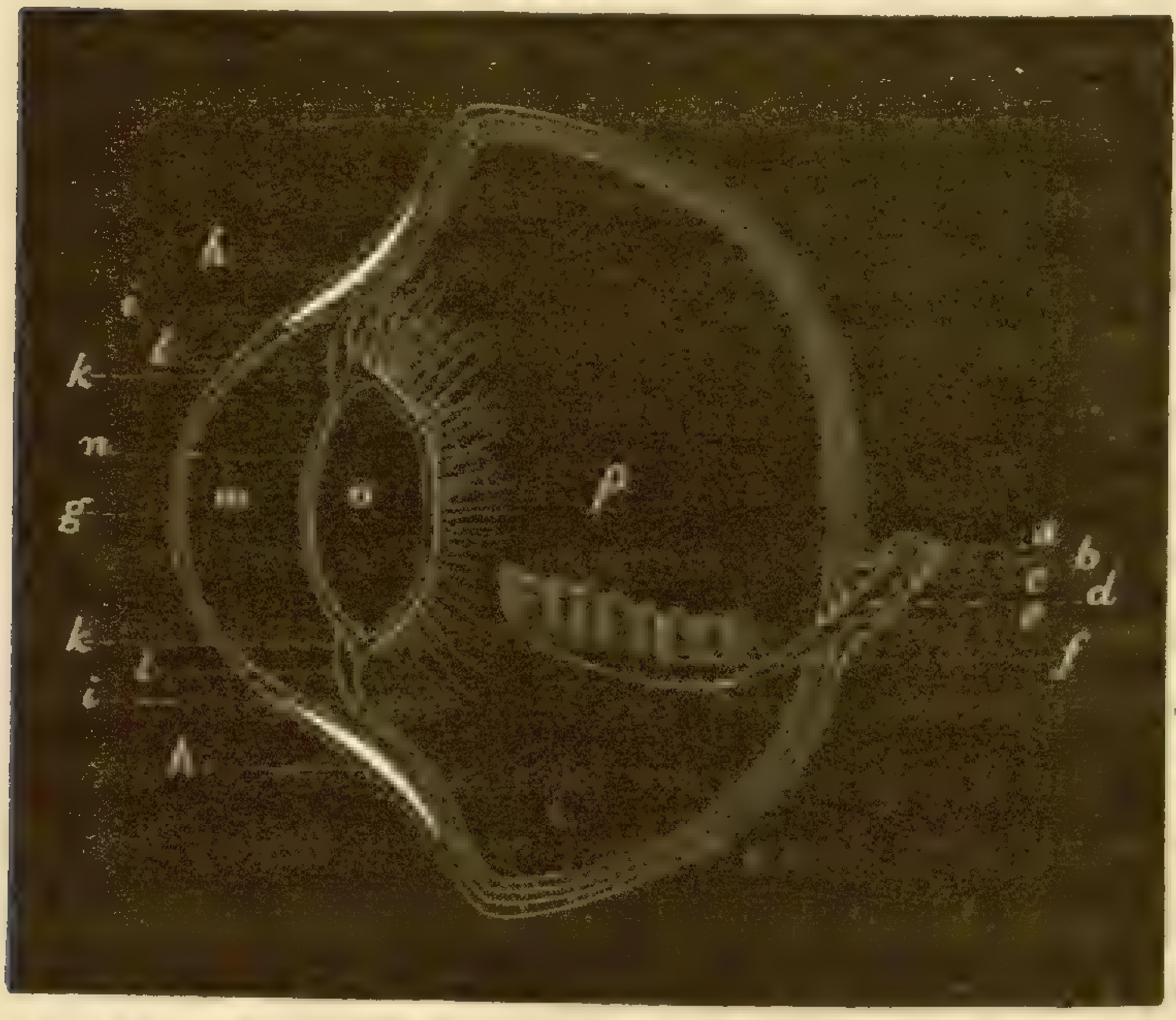
In our last "View" we saw all the appendages of a bird's eye; and now we come to look at the eye itself. "Eye-ball" and "globe of the eye" are very convenient terms, constantly in our mouths; but they are not strictly accurate ones. Probably there are no perfectly spherical eyes. In our own species, the eye is made up of a segment of a large sphere, representing about five-sixths of its superficies; the other sixth is a smaller segment of a small sphere, joined in front to the former. Most mammal's eyes are not very different in this respect from our own. Bird's eyes are much further removed from perfect sphericity. The greater part of the ball is saucer-shaped,—almost discoidal; and there is a very convex prominence, more or less hemispherical in shape, in front. The whole eye may be likened to an acorn of one of those oaks that bear a fruit with a heavy broad shallow cup, and short blunt kernel, or to a thick old-fashioned watch with a very convex crystal.

This shape is one of the distinguishing characters of a bird's eye: the figure (Fig. 2) will give a better idea of it than any description. It represents a vertical section through the middle of an eye in profile, and shows nearly all the structures and organs that can be demonstrated in the ball. Before making use of it, however, the reader must be reminded of the two following points: First, the distinctness of the several membranes forming the ball is greatly exaggerated; for otherwise the different membranes could not be represented as such. Secondly, the ciliary processes, optic nerve, and marsupium, do not fall wholly within the line of a vertical section; they lie curving obliquely against the inside of the walls of the hollow spheroid. But no idea whatever

could be gained of them, were they merely represented at the isolated points where they cross the vertical plane; and they are therefore introduced somewhat artificially. The sacrifice of theoretical accuracy is more than compensated for by increased perspicuity.

Recollecting that the "eyeball"—as we shall continue to call it for convenience sake—is filled with fluid that presses equally in every direction, we cannot at first make out how its peculiar shape is maintained. But the reason why the ball does not assume a spherical shape really is plain enough when we come to dissect its coats. They are partly *bony*. They are splinted, as it were, with the bones (*h*, *h*) that are packed alongside each other all around the circumference of one part of the ball.

Fig. 2.*



The large discoidal segment of a bird's eye is mostly made up of a membrane called the *sclerotic*, from its hard, dense structure. It is a thick, strong, tough membrane, of a glistening livid, or grayish blue color. Three sclerotic coats or layers, differing from each other a little in texture, may be demonstrated by careful dissection, though on super-

*Fig. 2. Vertical antero-posterior section through middle of eyeball. *a*, optic nerve; *b*, sclerotic, outer coat; *c*, sclerotic, middle and inner coats; *d*, choroid; *e*, hyaloid; *f*, marsupium; *g*, cornea; *h*, *h*, bony plates between layers of sclerotic; *i*, *i*, corrugations of choroid, forming the ciliary processes; *k*, *k*, canal of Petit; *l*, *l*, iris; *m*, anterior chamber; *n*, capsule of lens; *o*, lens; *p*, posterior chamber. Neither the retina nor the peculiar sheathing of the optic nerve, is shown. The nerve, the marsupium, and the ciliary processes, do not wholly fall within a vertical section through the middle of the eye, and cannot be represented in this figure except artificially.

ficial examination the sclerotic presents itself as a single homogeneous tissue. In the figure (*b*) is the outer coat, and (*c*) the middle and inner ones combined. The osseous plates just mentioned lie between the outer and middle sclerotic coats, anterior to the greatest circumference of the eyeball, and nearly or quite extend from the rim of the disk to the edge of the central anterior transparent part of the ball—the *cornea*. They are fifteen or twenty in number, of an oblong, quadrate shape, broader behind, tapering toward the cornea, and so disposed as to form a complete bony circlet around the latter. Collectively, they enjoy some little motion, their anterior margins advancing and receding with the varying convexity of the cornea; but they cannot individually wabble, being firmly bound to each other by the continuation of the sclerotic coats between them.

The *cornea* (*g*) is the thin transparent membrane in front that the bird looks through. It forms the anterior part of the wall of the eye, and is, in one sense, a continuation of the sclerotic; but its texture is very different from that of the latter. It is the prominent convex part of the eye,—the hemisphere of the small globe that has been already mentioned. Its structure offers nothing peculiar, being essentially the same as in mammals; but its shape is remarkable. Always very convex, it is sometimes still more protuberant, being elongated into a sort of cylinder, with a hemispherical top. This tubulation is very great, for example, in the nocturnal birds of prey (Owls, *Strigidæ*). The alteration of shape that the cornea is capable of is next most singular, as will be explained when we come to speak of the powers of the eye as a whole. It is sufficient here to bear in mind the unusual shape of the cornea, and its power of increasing and diminishing its convexity.

The sclerotic coat is lined inside with a membrane of very different tissue—the *choroid* (*d*). While the former is tough and fibrous, with comparatively few blood-vessels, the latter is more loosely woven of cellular tissue, replete with

interlacing blood-vessels, and painted pitch-black all over. The deposit of pigmentary or black coloring matter is very heavy, and serves to absorb those rays of light not needed in vision. The choroid membrane lines all the inside of the eye as far forward as the edges of the bony plates, where it splits into two layers. The *inner* of these turns away from the wall of the ball, towards the axis or middle line of the eye, and in so doing becomes gathered in plicæ, or folds, much as the top of a bag is wrinkled by pulling the string. These radiating folds come from all around, to collect together upon the rim of the crystalline lens (*o*), or rather of the delicate capsule (*n*) that encloses the lens, and adhere there. Their terminations form what are called the *ciliary processes* (*i*, *i*). The *outer* layer also curls away from the sclerotic, and starts to go transversely across the eyeball, but ends at once in the iris.

The *iris* (*l*, *l*) is the most exquisitely beautiful structure in a bird's eye. It is the many-colored curtain that hangs vertically between the two apartments of the eye. It is the highly ornamented framework of the window of the eye, uniting the offices of sash and blind. The crystalline lens is suspended in the round hole punched in the centre of the iris. Viewed in front, from the outside, the iris appears as a colored circular band around the pupil. It seems to lie directly on the surface. But this is not so, for the cornea and its humors are between us and it. It is like the dial-plate of a watch, that we look straight at without noticing the crystal that is interposed. The central aperture through which come the shafts that the hands are fastened to, may be likened to the pupil. Everybody knows what the "pupil" is, in a vague way. It is the round black spot inside the colored rim of the iris; but few understand what the spot is. The difficulty is, that the pupil is regarded as a material thing—a tissue, structure, or organ—when it is not. It is the absence of matter. The round black spot called the pupil is not a "thing;" it is a hole in a thing,—the hole in

the iris through which we look (the transparent crystalline lens offering no obstruction to our view) directly into and across the posterior chamber of the eye, and see the black pigment on the choroid behind. Albino animals have pink eyes, because the coloring matter of the choroid is wanting, and the hue of the blood in its numerous fine vessels appears. And even if we look into a normal eye with the ophthalmoscope, we have a reddish instead of a black field of vision. The pupil takes its name from a very pretty conceit. On looking straight at it, our image is reflected to us, only so diminished that we are transformed into pigmies. We find an expression of the same thing in other languages beside our own. In Spanish, the liliputian photograph is called "niñacita del ojo;" which means "little eye-baby."

But to return from this digression to the iris, which has been all the time nervously quivering at our neglect. It is essentially similar in structure to the choroid, being a delicate tissue of fibres and vessels interlacing in every direction; but it has, in addition, a structure that is regarded as muscular. The iridian muscles are mainly disposed in two ways; there is a circular set running around, and a radiating set that pass across from the inner to the outer border. By means of these, which are mutually antagonistic, the iris is contracted and expanded, and its aperture—the pupil—correspondingly varied in size. In mammals, the movement of the iris appears to be automatic, and to depend upon the stimulus of light; and they are not so great, as a general rule, as in birds. In the latter, they are extraordinary, not only in degree, but in the rapidity with which they may be executed. Although birds' irides respond primarily, and perhaps chiefly, to the action of light, their movements seem to be partly, at least, subject to the will, and therefore voluntary. These conditions of mobility in the iris relate directly to such exigencies as, for examples, the owl meets with in the daytime, or the eagle encounters in his flight towards the sun.

The iris of birds is copiously supplied with coloring matter; the tints vary with different species, and are often extremely brilliant. Some shade of brown is, perhaps, the commonest color. Yellow is very common; red is often seen; blue and green are more rarely met with. The eyes of Cormorants are of the latter color. Sometimes the iris is blackish, or black, like the choroid; and it is frequently pure white, as in the instance of one of our common birds, the White-eyed Greenlet (*Vireo Novæboracensis*).

The *crystalline lens* (*o*) is a transparent bi-convex disk, just like a common magnifying glass. It apparently hangs on the iris like a looking-glass in its frame, but is really set a little further back. In birds, it is rather flatter, especially behind, and also softer in consistency, than in some other classes. It is enclosed in a very delicate transparent membrane, its *capsule* (*n*), which is in turn set in between two layers of a membrane, called "hyaline," to be presently described. Where the two hyaloid layers separate around the rim of the capsule, to form its case, a small space is left, that makes a circular tube all around, called the *canal of Petit* (*k*, *k*). The lens is stationary as far as the axis of vision is concerned; but is capable of being moved a little forwards and backwards, by the pressure of the humors of the eye, which is produced by the coöperative action of certain muscular and vascular structures, as we shall see before we get through. This movement adjusts the focus for vision, exactly as it is adjusted in a telescope, for instance, by lengthening or shortening the tube.

We can understand, now, that the eyeball is divided into two compartments, or "chambers," as they are called, by the inward reflection of the two choroid coats, the hyaloid, the iris, and the lens, which together form a vertical wall. Both of these chambers are filled with fluid, of different density and consistence in each. That in the anterior division is thin and watery, and therefore called the "aqueous humor;" that in the posterior one is more dense and glassy, and is for

this reason known as the "vitreous humor." There is much less aqueous than vitreous, because the anterior chamber is much the smaller of the two; but birds have more of the former, compared with the quantity of the latter, than mammals, because the size and convexity of the cornea is relatively greater. The aqueous humor is enclosed in a very delicate simple membrane, that cannot be demonstrated without difficulty. The vitreous is contained in a more palpable, as well as complex membrane—the *hyaloid* (*e*)—which, besides lining the interior of all the back part of the eye, and enclosing the lens as already described, sends thin laminæ, or layers, all through the vitreous humor, forming partitions that serve to steady the glassy waters.

We may next turn our attention to the optic nerve (*a*) that presents itself in the all-important character of the "soul of the eye." It has many peculiarities in birds; among them one that constitutes the most characteristic feature of the eye of these creatures. In mammals, as a general rule, the nerve is a smooth cylinder that comes straight to the sclerotic, near the middle behind, penetrates straight through the coats of the eyeball, and then spreads out on all sides to form a disk on the inside of the back of the eye. This circular saucer-like expansion is the *retina*—the sensitive nervous plate, or mirror, upon which images of things viewed are photographed, to be transmitted along the nerve to the brain, and there "perceived." Suppose the optic nerve to be an umbrella-handle, the retina would then be the umbrella, blown inside out by the wind. In birds the nerve acts very differently. In the first place, though it is cylindrical, it is not smooth; it has lengthwise folds and ridges. It is like a fluted column. It comes obliquely towards the eye, which it strikes at a point eccentric from the axis of the ball; and then, instead of at once piercing all the sclerotic coats, and expanding into a concavo-convex disk, it tapers gradually to a fine point. This elongated extremity runs still obliquely, downwards and forwards, in a deep groove in the sclerotic, that

would be a perfect sheath were it not split lengthwise. Through this slit, and through a corresponding one in the choroid membrane, a fold or fluting of the nerve rises up, finally attaining the inside of the eye. The retina spreads out from all along the sides and extremities of this fold.

Only one other structure remains to be described—the crowning anatomical peculiarity of a bird's eye. This is the *marsupium*, or *pecten* (*f*). Though attached at one end to the optic nerve, it is not a part of the nerve at all, nor composed of nervous tissue. It is a very vascular membrane, most like the choroid in texture, and likewise painted black. When fully extended, it is seen to be of an oblong or rectangular shape; when lying naturally *in situ*, it is much drawn up, and its sides are transversely wrinkled or plicated. It is suspended in the vitreous humor, running obliquely forwards a great part, or the whole of the way, from the end of the optic nerve to the crystalline lens. In the former case it appears attached anteriorly to some of the laminæ of the hyaline; in the latter to the capsule of the lens. Behind, it is always fastened to the optic nerve. It is called the "marsupium," because it does not in the least resemble a purse or pouch; and the "pecten" because it does not look anything like a comb. Anatomists have not agreed upon what to consider as the function of this organ, nor upon the *quo modo* of its operation. Some have thought that it absorbs the superfluous rays of light that must often enter the eye, because it is blackened with pigment. One who adhered to this belief went further, considering that, from its eccentric position, it absorbs mainly oblique rays, which being taken away, objects placed in direct rays may be more plainly perceived. Some, again, have regarded it, in consequence of its vascular structure, as the organ that secretes, or aids the choroid in secreting the vitreous humor; an additional apparatus being needed for the elaboration of this fluid, because it is used up so fast in the rapid and incessant movements of the eye. But the theory now generally ac-

cepted differs from all of these hypotheses, and makes out the marsupium to be an "erectile" organ. Although no muscular fibres have been shown to exist in it, yet it is probably capable of expansion and contraction much as if it were muscular. It is a highly vascular structure, as we have seen; and the increased or diminished turgidity of its numerous blood-vessels* would, of course, alter its dimensions. If it occupies a variable space in the vitreous humor, it must affect the position of the lens, and by this means change the focus of the eye. This seems to be the most satisfactory explanation, both of the design of the marsupium, and of the mode in which its design is carried out. In this view, the organ is marshalled with several others that we know contribute to the greatest physiological phenomenon of a bird's eye,—the rapid adjustment of focus.

As anatomists, we have examined the structure, and position, and appearance of the organs that make up a bird's eye. But our study would be to little purpose if it ended here with an inspection of dead tissues. We have seen some curious things that, perhaps, have afforded us gratification, which is well enough as far as it goes; but curiosity is only laudable when, disdaining amusement as an ulterior object, it is contented only with a higher aim,—instruction. We must look, as physiologists, at the operations of the eye, and the mode in which its functions are conducted and accomplished. All that has gone before is merely to prepare us to question intelligently the structures we have examined, and find out how they work.

Eyes are made to see with, of course; but *how* we see with our eyes nobody knows. No one can tell us *how* an

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*It is not apparent, at first sight, whence the marsupium gets its numerous vessels, since it is not attached at all to the vascular membrane of the eye,—the choroid. Professor Owen remarks on this subject: "Branches of the ophthalmic artery, distinct from the vessels of the choroid, and homologous with the *arteria centralis retinæ*, enter the eye between the laminæ of the retina, along the whole extent of the oblique slit (in the sclerotic and choroid), and immediately penetrate the folds of the marsupial membrane, upon which they form delicate ramifications." (Anatomy of Vertebrates, Vol. II, p. 139.)

image formed on the retina is conveyed to the brain, and transformed into a mental perception, capable of being thought about. This is inscrutable; it is here the part of wisdom to confess ignorance, and acknowledge bounds that human reason cannot overstep. Nor have we need here to go into the general optical laws applicable to vision; they are well known, and moreover relate no more to a bird's eye than to that of any other animal. What we want is to find out the *meaning* of the structural peculiarities by which a bird's eye differs from other eyes. What is the reason and the purpose of the three eyelids? of the shape of the ball? of the very abundant aqueous humor? of the movable lens? of the marsupium? the tapering nerve? What special relation do these and other features bear to the sense of sight in birds? In other words, why must a bird have just this sort of an eye to be able to see perfectly? Some of these questions can be satisfactorily answered; others not. Some we have already replied to as they arose in our mind involuntarily during our dissection. Thus the third lid gives a subdued light, without excluding light altogether; and also protects the eye, which could not be otherwise protected without closure of its outer opaque lids, and loss of sight altogether. The very convex and highly refractive cornea doubtless has some relation to a bird's ability to see straight ahead, though its eyes look directly sidewise.

Perhaps no reason has been assigned for the singular course and termination of the optic nerve. These have possibly no special optical relations; the cause may lie simply in the relative situations of the brain and eye, which are such, that the nerve would have to change its course abruptly to pierce directly through the sclerotic. We cannot see through a crooked tube, any more than we can shoot round a corner. Nerves are the railroads of thought. A train of thought might run off the track if the curves and grades were not easy. I believe that we find comparatively few instances of abrupt angles in the course of nerves. If

we consider the marsupium as an erectile organ, we are not content to understand how it erects itself, and what it accomplishes by erection; we want to know why it is necessary or desirable that it should do what it does.

Putting together all that we do know of the operation of a bird's eye; and from this inferring some things that we do not know, we are irresistably led to the conclusion, that all the essential peculiarities of a bird's eye conspire to produce what we just now called its greatest physiological phenomenon—*instantaneous unerring adjustment of focus.*

Study of the habits of birds makes the necessity of some such faculty as this as evident as the fact of its existence. This admirable provision relates in the most direct manner possible to the rapid movements of birds in the air. As they dash onward in their airy course, the eye accommodates itself, if not with the speed of thought, at least with the speed of flight, to ever-varying distances, and surrounding objects, be they far or near, all alike rush into focus. With our own eyes, we see at once a book before us, and a large object in the distance. Push the book away by degrees; the letters run into words, words into lines, lines into paragraphs, paragraphs into a solid page of dark, surrounded by a white border; then the edges of the cover gain a film, the outlines soften, the thing becomes a spot, and finally disappears. If a bird were in our place, it would still see letters long after they had disappeared from our view. Its eye would change in shape, and the structures within alter in position, as the book moved off, slowly, gradually, constantly, till the limit of its power was reached; and this limit it need not be said, far exceeds ours. Walk towards the large object now indistinct in the distance. How long we are in approaching it: how very slowly it takes form as we advance, until it stands forth clearly in view! Let a wild duck fly at the rate of ninety miles an hour, towards the same object. How rapid must be the adjustment of its eyes compared with ours! But these are among the

moderate exhibitions of a bird's visual powers. Watch a Humming-bird: it darts away so swiftly that our eyes cannot follow it, and settles, light as a feather, upon a twig. We do not know how far off it discovered the twig; but, at whatever distance it was first brought into focus, the Humming-bird's eye adjusted itself during the fraction of a second that the bird was flying; and the twig was in focus at the instant the bird alighted upon it. Were we to move with the same velocity, our eyes would fail us; they could not accommodate themselves quick enough. See a Sparrow-hawk dash through a thick clump of bushes in headlong pursuit of its prey. Think you it rushes blindly, taking the chances of escaping the close-set obstacles in its way? It sees each stake and branch as it comes on, and avoids them all. Had we a Sparrow-hawk's power of flight we could not follow him for want of his powers of vision.

Observe an eagle circling in the air. He is soaring aloft higher and higher, till he becomes, to us, but a speck against the blue expanse. As he turns towards the sun, a signal is made, and quick as thought obedient servants obey the summons. The nictitating membrane, asleep in its corner, starts up and spreads over the cornea in an instant: the quivering iris, ever on the alert, enfolds the crystalline lens in a close embrace; and the tranquility of the retina is undisturbed. As he turns away, the enemy no longer harasses, and the guards retire. Now the great bird prepares to scan the ground below. His eye lies loosely in its socket; the muscles relax; the marsupium lies torpid; the lens falls back; the cornea sinks; the waters retire; all are quiet. The retina alone glows and thrills with excitement. He is now far-sighted; he descries an object on the earth smaller than himself, even from this vast height; and makes ready for the fearful plunge. He poises a moment; the word is given; as trusty sailors to their posts to save the good ship in a storm, so rush the sentinels of the eye into action. Down he swoops; the muscles tauten, and the waters rush forward;

the cornea feels the pressure within, and starts out; the marsupium stands erect, swelling and bristling all over, and the lens leaps forward, while the iris flaunts the flag of battle. Guided by such an instrument as this, the bird comes down with unerring aim upon his quarry; he seizes it in his talons; and now, become near sighted, well can he see to perform the bloody work before him.

There is, perhaps, as much to be seen in a view of a bird's eye, as ever lies within the bounds of a "bird's-eye view."

HABITS OF THE BURROWING OWL OF CALIFORNIA.

BY DR. C. S. CANFIELD.*

I WISH to state a few facts about the Burrowing Owl (*Athene cunicularia* Molina) that lives in California. I had almost constantly for four years opportunities of observing the habits of this little owl, which is really one of the most notable features in the natural history of California. A colony of these owls lived within one hundred yards of my cabin while I passed a frontier life; and they were very common everywhere in that vicinity. I have seen them every day for years, hundreds and perhaps thousands of them in all. Where I have seen them, they always live in the deserted or unoccupied burrows of the Ground Squirrel (*Spermophilus Beecheyi*). I came to the conclusion that they were able to drive out the Spermophiles from their habitations, but I am not certain of the fact. It is true that there were, in that region, always a large number of unoccupied burrows wherever there was a colony of Spermophiles; so that there was no lack of unoccupied habitations for the owls to take possession of. But I have noticed that wherever there was a large number of the owls, very few or no Sper-

*Communicated in a letter to the Smithsonian Institution, and forwarded by the Secretary for publication.

mophiles lived. *One* or *two* owls would occasionally be seen among a colony of Spermophiles, but they never appeared to live in the same hole or burrow with the squirrel; and I have never seen a squirrel enter a burrow that was occupied by owls, however much tempted by fear he might be to enter the first hole he should come to. True, the Spermophile never likes to enter any burrow but his own, and will run past any number of inviting entrances in order that he may at last hide himself in his own domicile. But aside from this, I believe that the squirrels are afraid of the owls, and do not dare to intrude upon them. The notion that the Athene digs its own burrow appears to me apocryphal and unreasonable. I have never seen any evidence of it. Negative evidence proves nothing; but yet the absence of facts is strong presumption against their existence, and it would be strange that I should never have seen any evidences of their digging powers if they have any. After a shower of rain, one sees fresh earth thrown out around the mouths of the burrows of the Spermophiles, but never anything of the kind around the burrows of the owls. They are not constituted for digging, and there is no necessity for it; they can always find any number of holes ready-made for them. That they live in peace and amity with the rattlesnake, I believe to be another error and stretch of the imagination. Rattlesnakes are very abundant where I lived, and I killed one or two almost every time that I rode a mile or more from the house, yet I never saw a rattlesnake near a squirrel's hole but once, and that hole was a deserted one. I once found a large rattlesnake swallowing a squirrel (*Spermophilus Beecheyi*) that it had caught, in the centre of a colony of squirrels, but several yards distant from any "squirrel-hole."

I once took pains to dig out a nest of the *Athene cunicularia*. I found that the burrow was about four feet long, and the nest was only about two feet from the surface of the ground. The nest was made in a cavity in the ground, of about a foot in diameter, well filled in with dry soft horse-

dung, bits of an old blanket, and fur of a Coyoté (*Canis latrans*) that I had killed a few days before. One of the parent birds (male or female?) was in the nest, and I captured it. It had no intention of leaving the nest, even when entirely uncovered by the shovel, and exposed to the open air. It fought bravely with beak and claws. I found *seven* young ones, perhaps eight or ten days old, well covered with down, but without any feathers. The whole nest, as well as the birds (old and young), swarmed with fleas. It was the filthiest nest that I ever saw. In the passage leading to the nest there were small scraps of dead animals; such as pieces of the skin of the antelope, half dried and half putrified, the skin of the coyoté, etc.; and near the nest were the remains of a snake that I had killed two days before, a large *Coluber?* two feet long. The birds had begun at the snake's head, and had picked off the flesh clean from the vertebræ and ribs for about one-half of its length; the other half of the snake was entire. The material on which the young birds nested was at least three inches in depth. I do not remember the time of the year.

The Burrowing Owls do not migrate. Where I lived they were as numerous in winter as in summer. Perhaps in low, flat plains, that are deluged or inundated by water in the winter, the little owl is obliged to have a far drier location, but I have never seen any such migration. They always remain in or near their burrows through the day, never leaving them to go any distance except when disturbed, when they make a short crooked flight to some other hole near by, and when driven from this last one return to the first again. When the sun sets they sally forth to hunt for food, etc., and are all night on the wing. I had seen them and heard them at all times of the night and early in the morning. They are not strictly nocturnal, for they do not remain in their nests or burrows all day, but their habits, in this respect, are about the same as those of the other owls, as *Strix pratincola*, *Nyctea nivea*, etc., or of the domestic cat.

There are very few birds that carry more rubbish into the nest than the *Athene;* and even the Vultures are not much more filthy. I am satisfied that the *Athene canicularia* lays a larger number of eggs than is attributed to it in Dr. Brewer's work. I have frequently seen, late in the season, six, seven or eight, young birds standing around the mouth of a burrow, isolated from others in such a manner that I could not suppose that they belonged to two or more families.

A CHAPTER ON FLIES.

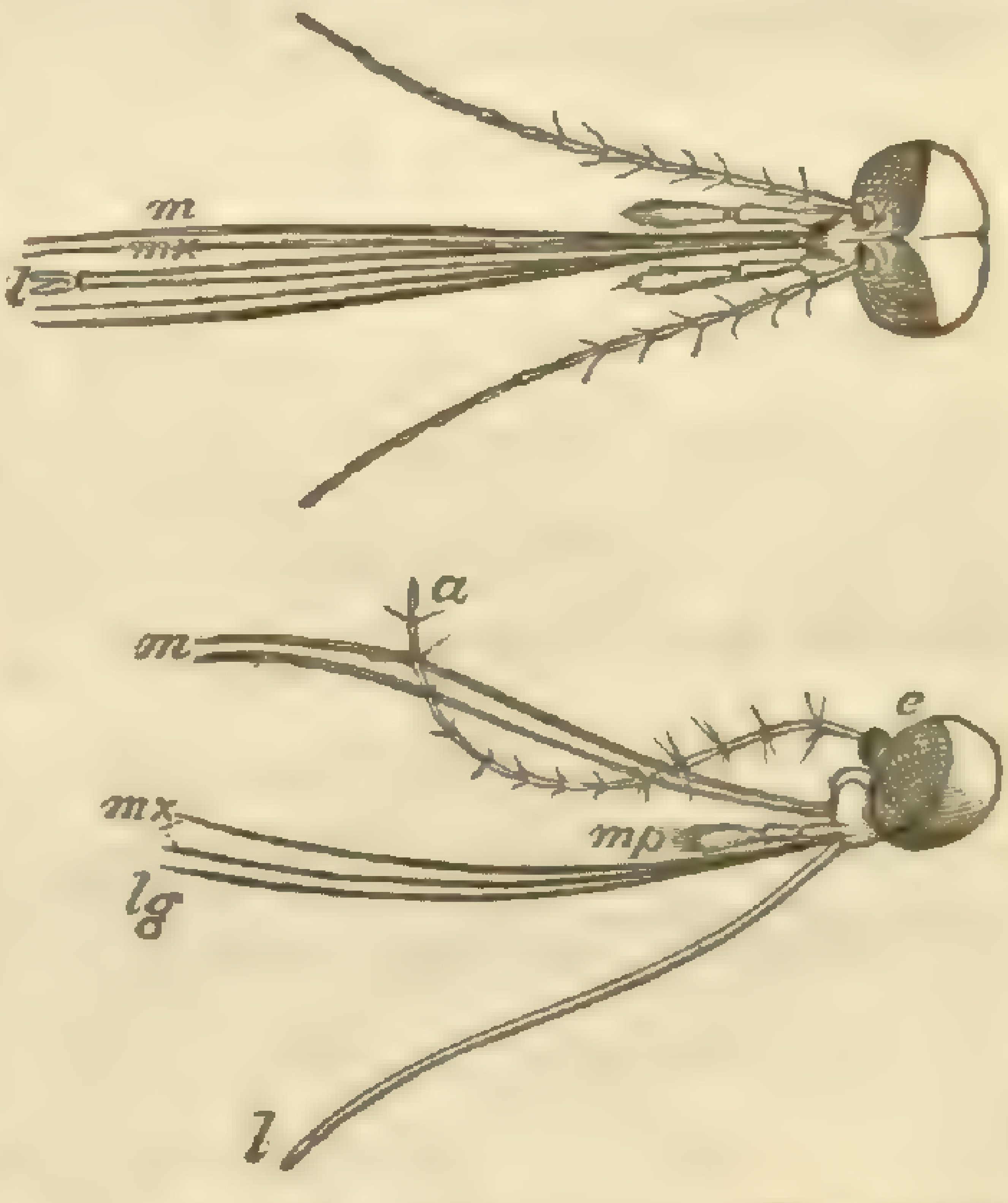
BY A. S. PACKARD, JR.

THE subject of flies becomes of vast moment to a Pharaoh, whose ears are dinned with the buzz of myriad winged plagues, mingled with angry cries from malcontent and fly-pestered subjects; or to the summer traveller in northern lands, where they oppose a stronger barrier to his explorations than the loftiest mountains or the broadest streams; or to the African pioneer, whose cattle, his main dependence, are stung to death by the Tsetze fly; or the farmer whose eyes on the evening of a warm spring day, after a placid contemplation of his growing acres of wheat-blades, suddenly detects in dismay clouds of the Wheat-midge and Hessian-fly hovering over their swaying tops. The subject, indeed, has in such cases, a national importance, and a few words regarding the main points in the habits of flies—how they grow, how they do not grow (after assuming the winged state), and how they bite; for who has not endured the smart and sting of these dipterous Shylocks, that almost torment us out of our existence while taking their drop of our heart's blood—may be welcome to the readers of the NATURALIST.

The Mosquito will be our first choice. As she leaps off

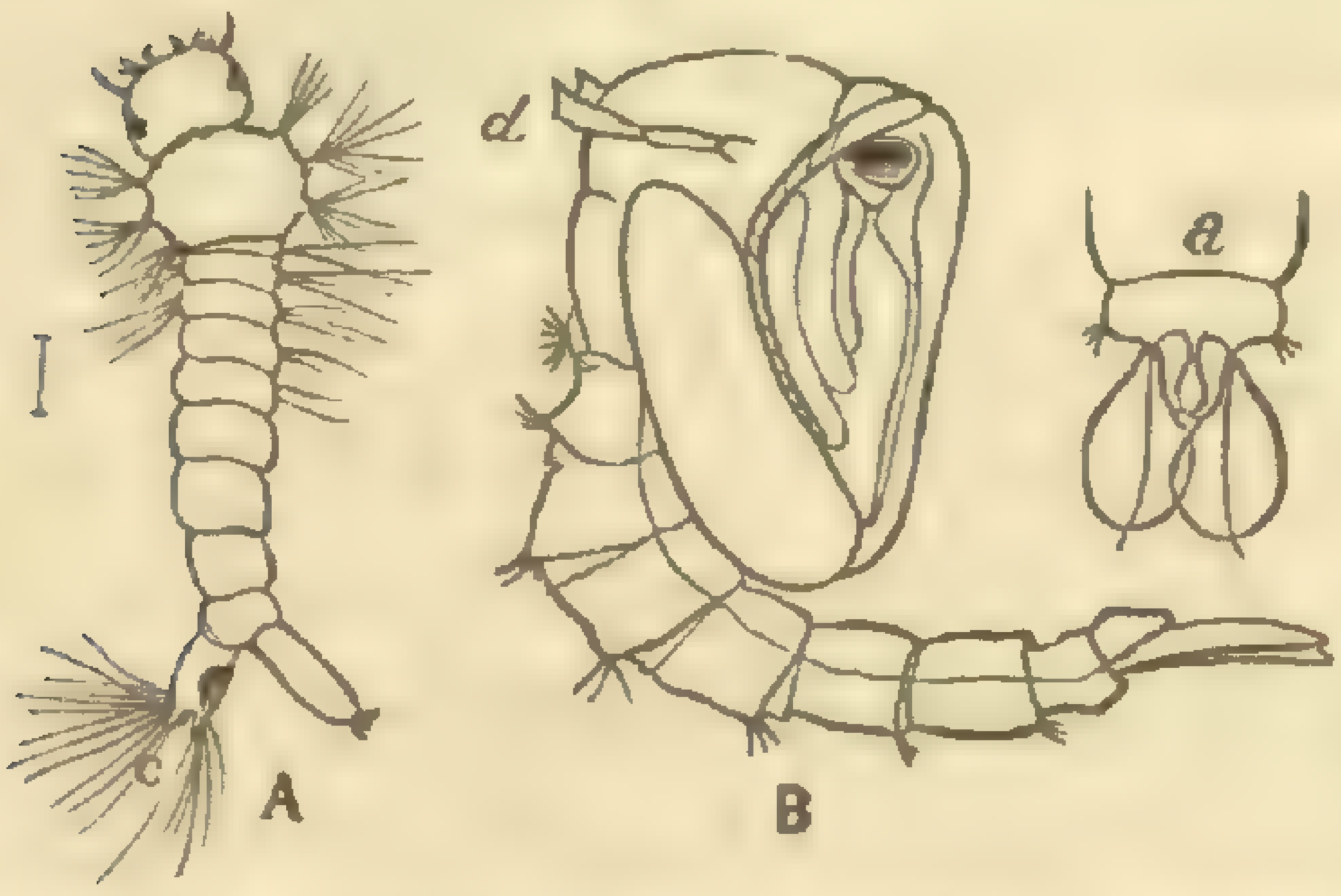
from her light bark, the cast chrysalis skin of her early life beneath the waters, and sails away in the sunlight, her velvety wings fringed with silken hairs, and her neatly bodiced trim figure (though her nose is rather salient, considering that it is half as long as her entire body), present a beauty and grace of form and movement quite unsurpassed by her dipterous allies. She draws near and softly alights upon the hand of the charmed beholder, subdues her trumpeting notes, folds her wings noiselessly upon her back, daintily sets down one foot after the other, and with an eagerness chastened by the most refined delicacy for the feelings of her victim, and with the air of Velpeau redivivus drives through crushed and bleeding capillaries, shrinking nerves and injured tissues, a many-bladed lancet of marvellous fineness, of wonderful complexity and fitness. While engorging herself with our blood, we will examine under the microscope the mosquito's mouth. The head (Fig. 1) is rounded, with the two eyes occupying a large part of the surface, and nearly meeting on the top of the head. Out of the forehead, so to speak, grow the long, delicate, hairy antennæ (*a*), and just below arises the long beak which consists of the bristle-like maxillæ (*mx*, with their palpi, *mp*) and mandibles (*m*), and the single hair-like labrum, all which five bristle-like organs are laid in the hollowed labium (*l*). Thus massed into a single awl-like beak, the mosquito, without any apparent effort, thrusts them into the flesh, and by aid of the sucker-like expansion of the end of the labium, draws in the blood through the channel formed by the five bristles and their sheath. Her hind-body may be seen filling with the red blood, until it cries quits, and the insect with-

Fig. 1.



draws its sting and flies sluggishly away. In a moment the wounded parts itch slightly, though a very robust person may not notice the irritation, or a more delicate individual if asleep; though if weakened by disease, or if stung in a highly vascular and sensitive part, such as the eyelid, the bites become really a serious matter. Multiply the mosquitoes a thousand fold, and one flees their attacks and avoids their haunts as he would a nest of hornets. Early in spring the larva (Fig. 2, A) of the mosquito may be found in pools and ditches. It remains at the bottom feeding upon decaying matter, thus acting as a scavenger, and in this state doing great benefit in clearing swamps of miasms, until it rises to the surface for air, which it inhales through a single respiratory tube (c) situated near the tail. When about to transform into the pupa state, it contracts and enlarges anteriorly near the middle, the larval skin is thrown off, and the insect appears in quite a different form (Fig. 2, B; for which we are indebted to Mr. E. Burgess). The head and thorax are massed together, the rudiments of the mouth-parts and of the wings and legs being folded upon the breast, and there are two breathing tubes (d) situated upon the back instead of the tail, which ends in two broad paddles (a); so that it comes to the surface head foremost instead of tail first, a position according better with its increased age and experience in pond life. In a few days the pupa skin is cast, the insect, availing itself of its old habiliments as a raft upon which to float while its body is drying, grows lighter, and its wings expand for its marriage flight. The males are beautiful, both physically and morally, as they do not bite; their manners are more retiring than those of their stronger minded partners, as they rarely enter our dwellings, and live unnoticed in the woods. They may be easily

Fig. 2.



distinguished from the females by their long maxillary palpi, and their thick, bushy, feathered antennæ. The female lays her elongated oval eggs in a boat-shaped mass, which floats on the water. A mosquito lives three or four weeks in the water before changing to the adult or winged stage. Just how many days they live in the latter state we do not know.

Our readers will understand then, that all flies, like our mosquito for example, grow while in the larva and pupa state, *and after they acquire wings do not grow*, so that the small midges are not young mosquitoes, but the adult winged forms of an entirely different species and genus of fly, and the myriads of small flies, commonly supposed to be the young of larger flies, are adult forms belonging to different species of different genera, and perhaps of different families of the suborder of Diptera. The typical species of the genus Culex, to which the mosquito belongs, is *Culex pipiens*, described by Linnæus, and there are already over thirty North American species of this genus described in various works. The habits of a fly allied to the mosquito are given, with illustrations, in the July number of the NATURALIST, which farther elucidates the habits of these insects. The Hessian-fly and Wheat-midge are briefly referred to and figured on page 163, so that we pass over these to consider another pest of our forests and prairies.

The Black fly is even a more formidable pest than the mosquito. In the northern, subarctic regions, it opposes a barrier against travel. The Labrador fisherman spends his summer on the seashore, scarcely daring to penetrate the interior on account of the swarms of these flies. During a summer residence on this coast, we sailed up the Esquimaux river for six or eight miles, spending a few hours at a house situated on the bank. The day was warm and but little wind blowing, and the swarms of black flies were absolutely terrific. In vain we frantically waved our net among them, allured by some rare moth; after making a few desperate charges in the face of the thronging pests, we had to retire to the

house, where the windows actually swarmed with them; but here they would fly in our face, crawl under one's clothes, where they even remain and bite in the night. The children in the house were sickly and worn by their unceasing torments; and the shaggy Newfoundland dogs, whose thick coats would seem to be proof against their bites, ran from their shelter beneath the bench and dashed into the river, their only retreat. In cloudy weather, unlike the mosquito, the black fly disappears, only flying when the sun shines. The bite of the black fly is often severe, the creature leaving a large clot of blood to mark the scene of its surgical triumphs. Mr. E. T. Cox, of New Harmony, Indiana, has sent us specimens of a much larger fly, which Baron Osten Sacken refers to this genus, which is called on the prairies, the Buffalo Gnat, where it is said to bite horses to death. Westwood states that an allied fly (*Rhagis Columbaschensis* Fabr.) is one of the greatest scourges of man and beast in Hungary, where it has been known to kill cattle.

The *Simulium molestum* (Pl. 12, fig. 1, enlarged), as the black fly is called, lives during the larva state in the water. The larva of a Labrador species (Pl. 12, fig. 2, enlarged) which we found, is about a quarter of an inch long, and of the appearance here indicated. The pupa is also aquatic, having long respiratory filaments attached to each side of the front of the thorax. According to Westwood, "the posterior part of its body is enclosed in a semioval membranous cocoon, which is at first formed by the larva, the anterior part of which is eaten away before changing to a pupa, so as to be open in front. The imago is produced beneath the surface of the water, its fine silky covering serving to repel the action of the water."

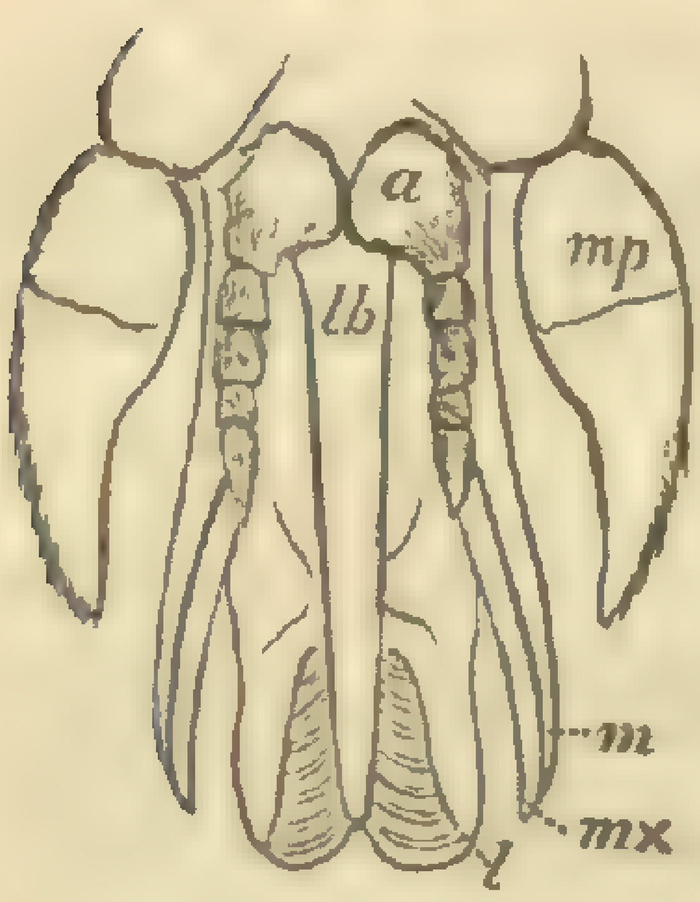
Multitudes of a long slender white worm may often be found living in the dirt, and sour sap running from wounds in the elm tree. Two summers ago we discovered some of these larvæ, and on rearing them found that they were a species of *Mycetobia* (Pl. 12, fig. 3; *a*, larva; *b*, pupa). The

larva is remarkable for having the abdominal segments divided into two portions, the hinder much smaller than the anterior division, and its whole length is .36 of an inch. The pupæ were found sticking out in considerable numbers from the tree, being anchored by the little spines at the tail. The head is square, ending in two horns, and the body is straight and covered with spines, especially towards the end of the tail. They were .20 of an inch in length. The last of June the flies appeared, somewhat resembling gnats, and about .10 of an inch long. The worms continued to infest the tree for six weeks, the flies remaining either upon or near the tree.

We now come to that terror of our equine friends, the Horse-fly, Gad, or Breeze-fly. In its larval state, some species live in water, and in damp places under stones and pieces of wood, and others in the earth away from water, where they feed on animal, and, probably, on decaying matter. Mr. B. D. Walsh found an aquatic larva of this genus, which, within a short time, devoured eleven water snails. Thus at this stage of existence, this fly, often so destructive, even at times killing our horses, is beneficial. We have found a larva (Pl. 12, fig. 4), which is, probably, a young Horse-fly, living in abundance on the under side of the stones in a running brook, at Burkesville Junction, Va. The body was smooth, over two inches in length, and with a few fleshy filaments at the tip. Each segment is enlarged posteriorly, aiding the creature in moving about. During the hotter parts of summer, and when the sun is shining brightly, thousands of these Horse-flies appear on our marshes and inland prairies. There are many different kinds, over one hundred species of the genus Tabanus alone, living in North America. Our most common species is the "Green-head," or *Tabanus lineola* Fabr. (Pl. 12, fig. 5; from Tenney's Zoölogy). When about to bite, it settles quietly down upon the hand, face or foot, it matters not which, and thrusts its formidable lancet jaws deep into the flesh. Its bite is very painful, as

we can testify from personal experience. We were told during the last summer that a horse, which stood fastened to a tree in a field near the marshes at Rowley, Mass., was bitten to death by these Green-heads; and it is known that horses and cattle are occasionally killed by their repeated harassing bites. In cloudy weather they do not fly, and they perish on the cool frosty nights of September. The Timb, or Tsetze-fly, is a species of this group of flies, and while it does not attack man, plagues to death, and is said to poison by its bite, the cattle in certain districts of the interior of Africa, thus almost barring out explorers. On comparing the mouth-parts of the Horse-fly (Fig. 3, mouth of *T. lineola*), we have all the parts seen in the mosquito, but greatly modified. Like the mosquito, the females alone bite, the male Horse-fly being harmless, and frequenting flowers, living upon their sweets. The labrum (*lb*), mandibles (*m*), and maxillæ (*mx*), are short, stiff, and lancet-like, and the maxillary palpi (*mp*, the five terminal points of the antennæ) are large, stout, and two-jointed. While the jaws (both maxillæ and mandibles) are thrust into the flesh, the tongue (*l*) spreads around the tube thus formed by the lancets, and pumps up the blood flowing from the wound, by aid of the sucking stomach, or crop, being a sac appended to the throat. Other Gad-flies, but much smaller, though as annoying to us in woods and fields, are the species of Golden-eyed flies, *Chrysops*, which fly and buzz interminably about our ears, often taking a sudden nip. They plague cattle, settling upon them and drawing their blood at their leisure.

Fig. 3.



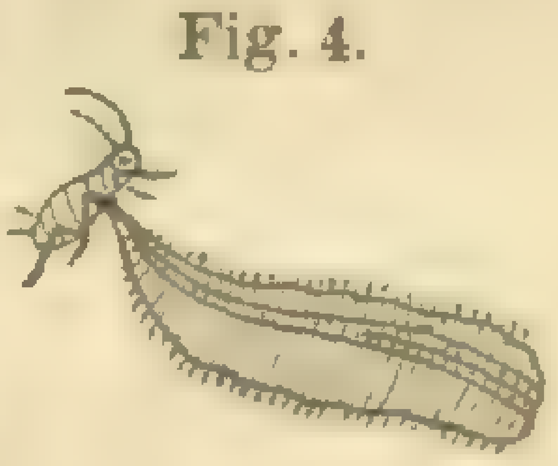
We turn to a comparatively unknown insect, which has occasionally excited some distrust in the minds of housekeepers. It is the Carpet-fly, *Scenopinus pallipes* Say (Pl. 12, fig. 6), which, in the larva state, is found under carpets, on which it is said to feed. The worm (Pl. 12, fig. 7) has a long, white, cylindrical body, divided into twelve segments,

exclusive of the head, while the first eight abdominal segments are divided by a transverse suture, so that there appears to be seventeen abdominal segments, the sutures appearing too distinct in the cut. Mr. F. G. Sanborn has reared the fly, here figured, from the worm. The larva also lives in rotten wood; it is too scarce to ever prove very destructive in houses.

One of the most puzzling objects to the collector of shells or insects, is the almost spherical larva of *Microdon globosus* Fabr. (Pl. 12, fig. 8; fig. 8 *c*, larva just before pupation; *a*, puparium; *s*, spiracular tubercles; *v*, vent; *b*, anterior view of pupa case), which has been traced to its fly-state by Mr. F. G. Sanborn.

The Syrphus fly, or Aphis-eater, deserves more than the passing notice which we bestow upon it. The maggot (Fig. 4, in the act of devouring an Aphis) is to be sought for established in a group of plant-lice (Aphis), which it seizes by means of the long extensible front part of the body. The adult fly (Pl. 12, fig. 9) is gaily spotted and banded with yellow, resembling closely the wasps, and frequents flowers.

Fig. 4.



We have figured in the NATURALIST (p. 278) the singular rat-tailed pupa-case of Eristalis, and now present the figure of an allied fly, *Merodon Bardus* Say (Pl. 12, fig. 10; *a*, puparium, natural size). We will not describe at length the fly, as the admirable drawings of Mr. Emerton cannot fail to render it easily recognizable. The larva is much like the puparium or pupa-case, here figured, which closely resembles that of Eristalis, in possessing a long respiratory filament, showing that the maggot undoubtedly lives in the water, and when desirous of breathing, protrudes the tube out of the water, thus drawing in air enough to fill its internal respiratory tubes (tracheæ). The *Merodon Narcissa*, also reared by Mr. Sanborn, probably lives in the soil, or in rotten wood, as the pupa-case has no respiratory tube, having instead a very short sessile truncated tube, scarcely as

long as it is thick. The case itself is cylindrical, and rounded alike at each end.

We now come to the Bot-flies (*Œstridæ*), which are among the most extraordinary, in their habits, of all insects. The history of the bot-flies is in brief thus: The adult two-winged fly lays its eggs on the exterior of the animal to be infested. They are conveyed into the interior of the host, where they hatch, and the worm or maggot lives by sucking in the purulent matter, caused by the irritation set up by its presence, in its host; or else the worm itself, after hatching, bores under the skin. When fully grown, it quits the body and finishes its transformations to the fly-state under ground. Many quadrupeds, from mice, squirrels and rabbits, up to the ox, horse, and even the rhinoceros, suffer from their attacks, while man himself is not exempt. The body of the adult fly is stout and hairy, and it is easily recognized by having the opening of the mouth very small, the mouth-parts being very rudimentary. The larvæ are, in general, thick, fleshy, footless grubs, consisting of eleven segments, exclusive of the head, which are covered with rows of spines and tubercles, by which they move about within the body, thus irritating the animals in which they take up their abode. The breathing pores (stigmata) open in a scaly plate at the posterior end of the body. The mouth-parts (mandibles, etc.) of the subcutaneous larvæ consist of fleshy tubercles, while in those species which live in the stomachs and frontal sinuses of their host, they are armed with horny hooks. The larvæ attain their full size after moulting twice. Just before assuming the pupa state, the larva leaves its peculiar dwelling-place, descends into the ground and there becomes a pupa, though retaining its larval skin, which serves as a protection to it, whence it is called a "puparium."

Several well-authenticated instances are on record of a species of bot-fly inhabiting the body of man, in Central and South America, producing painful tumors under the

skin of the arm, legs and abdomen. It is still under dispute whether this human bot-fly is a true or accidental parasite, the more probable opinion being that its proper host is the monkey, or dog. In Cayenne, this revolting grub is called the *Ver macaque* (Pl. 12, fig. 11); in Para, *Ura;* in Costa Rica, *Torcel;* and in New Grenada, *Gusano peludo*, or *Nuche*. The *Dermatobia noxialis*, supposed to be the *Ver moyocuil* of the inhabitants of Mexico and New Grenada, lives beneath the skin of the dog.

The Bot-fly of the horse, *Gastrophilus equi* (Pl. 12, fig. 12; from Tenney's Zoölogy; *a*, larva), is pale yellowish, spotted with red, with short, grayish, yellow hairs, and the wings are banded with reddish. She lays her eggs upon the knees of the horse. They are conveyed into the stomach, where the larva lives from May until October, and when full grown are found hanging by their mouth-hooks on the edges of the rectum of the horse, whence they are carried out in the excrement. The pupa state lasts for thirty or forty days, and the perfect fly appears the next season, from June until October.

The Bot-fly of the ox, *Hypoderma bovis* (Pl. 12, fig. 13; fig. 14, larva), is black and densely hairy, and the thorax is banded with yellow and white. The larva is found during the month of May, and also in summer, living in tumors on the back of cattle. When fully grown, which is generally in July, they make their way out and fall to the ground, and live in the puparium from twenty-six to thirty days, the fly appearing from May until September. It is found all over the world. The *Œstrus ovis*, the sheep Bot-fly, is of a dirty ash color. The abdomen is marbled with yellowish and white flecks, and is hairy at the end. The larva lives, during April, May and June, in the frontal sinus of the sheep, and also in the nasal cavity, whence they fall to the ground when full grown. In twenty-four hours they change to pupæ, and the fly appears during the summer.

We also figure the *Cuterebra buccata* (Pl. 12, fig. 15; *a*,

side view; from the collection of Mr. F. G. Sanborn), which resembles the ox Bot-fly in the larval state. Its habits are not known, though the young of other species infest the opossum, squirrel, hare, etc., living in subcutaneous tumors. — *To be concluded.*

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER, M. D.

(Continued from page 538.)

II. BIRDS.

TURKEY BUZZARD (*Cathartes aura*). Occasionally seen through the Rocky Mountains, but not very common.

PIGEON HAWK (*Falco columbarius*). I saw no Pigeon Hawks until I reached Cœur d'Aleñe Mission, where I obtained the very fine specimen preserved.

SPARROW HAWK (*Falco sparverius*). Common in all open regions.

MEXICAN HAWK (*Accipiter Mexicanus*). No. 92 (♂ ?). Bitterroot river, September 2. Length, 16.50; extent, 27.50; wing, 9. Iris and feet greenish yellow. This specimen and the next would be supposed to be of the same species, but their dimensions differ too much, and do not agree well with those of either of the three *Accipitres*, in which "size is a specific character." (Cassin).

SHARP-SHINNED HAWK (*A. fuscus*). No. 82 (♀ ?). Bitterroot river, August 30, 1860. Length, 14; extent, 26.75; wing, 5.50. The sex of these last two specimens being uncertain on account of their youth, I can only guess at it from their dimensions, and the wing in this one is very short, even for a male bird.

Hawks were rather scarce during my stay in the Rocky Mountains, the older birds having probably left the valleys to

PACKARD ON FLIES.

raise their young in the higher forests, and the young just began to appear in the end of August.

MARSH HAWK (*Circus Hudsonius*). The Marsh Hawk is probably the most universally diffused hawk on the continent, and is seen almost daily at all seasons, where there are open prairies or meadows and not much population.

GOLDEN EAGLE (*Aquila Canadensis*). Though I did not see the Golden Eagle in the Rocky Mountains, so near as to be sure of the species, it evidently inhabits them, as I saw several young ones at Fort Benton, which had been trapped by the Indians soon after they could fly, and were doubtless raised in the mountains. They probably find prey more easily caught on the Great Plains, and have not yet been observed west of the mountains where the White-headed Eagle is so abundant, while the latter is quite scarce on the plains, though sometimes seen.

FISH HAWK (*Pandion Carolinensis*). Not seen near the muddy waters of the Missouri below Fort Benton, but common, and its nests numerous on the rivers, and their branches from there westward, where it finds an abundance of delicious trout and other fish in the clear streams.

WILSON'S OWL (*Otus Wilsonianus*). A specimen was knocked down by a soldier with a stick near Bitterroot ferry, Sept. 4th, and I rode close by one sitting in a bush near Cœur d'Aleñe Mission, on the 15th, so that it seems to be generally distributed across the continent, being common also in the bushes along streams on the plains. It seems indeed to shun dense forests, not having been observed by me west of the Cascade Mountains.

YELLOW-BILLED CUCKOO (*Cocygus Americanus*). I saw this Cuckoo near Fort Benton, but not in the Rocky Mountains, although it may have left for the south when I reached there (Aug. 15), as it departs early. I should expect to find it a month earlier, as Nuttall "met with it in Oregon." (Mammal, I, 652.)

HARRIS'S WOODPECKER (*Picus Harrisii*), and GAIRDNER'S

WOODPECKER (*P. Gairdneri*) were seen abundantly from the eastern base of the mountains westward.

WHITE-HEADED WOODPECKER (*Picus albolarvatus*). First met with by me, as in 1853, at the Spokan river, September 24; and at Fort Colville, a week later, I saw several. They were very shy, and made a shrill note of alarm, much like that of some squirrels, for which I at first looked out on hearing it. At Fort Dalles, I found a family of them associating near the quarters, and quite tame, so that I obtained three fine specimens. They prefer open pine woods, and seek for food chiefly in the bark of the Yellow-pine (*Pinus ponderosa*), the prevailing tree in the above localities. In notes and habits they most resemble the small Sap-suckers, and associate with them.

ARCTIC WOODPECKER (*Picoides arcticus*). I first met with the large Three-toed Woodpecker, at the crossing of the Bitterroot, September 6th, where the open woods, before traversed, were exchanged for a very dense growth, with several kinds of common spruce, which had not been before seen. In these dark forests I found this and the striped species (*P. dorsalis*) the commonest woodpeckers, but also saw many of this kind afterwards in the more open pine forests between Spokan river and Fort Colville, where I also saw them in October, 1853.

STRIPED-BACK WOODPECKER (*Picoides dorsalis*). No. 100 (♂), shot September 7th, near crossing of Bitterroot river. Length, 9.75; extent, 15.25; wing, 4.75. No. 104 (♀), shot September 9th, at dividing ridge of Cœur d'Aleñe Mountains. Length, 8.50; extent, 14.50; wing, 3.75. Iris, brown; bill, slaty black; feet, gray in both. I saw this species but once besides, at the west base of the same mountains. At each time I found it very silent (being led to it by its tapping on the trees), quite fearless, and frequenting only the low, generally fallen trunks, in the most dense part of the forest. I had, of course, little opportunity to notice its habits farther than this. All seen were at an

elevation of over 3500 feet above the sea, but not in an Alpine region, at least in September, though there was slight frost at night, and snow falls from three to six feet deep in winter.

Red-necked Woodpecker (*Sphyrapicus nuchalis*). I first met with this beautiful species along the Hell Gate river, August 25th (No. 73), and afterwards found it rather common, but very shy, as far as the Bitterroot crossing. It was not seen in the dense forests west of this, but reappeared quite abundantly, though moulting and bad in plumage, at the Cœur d'Aleñe Mission. I suppose, therefore, that it extends around the north end of these mountains through the valley of Clark's Fork. I commonly found it frequenting dense thickets of willows, etc., tapping their bark, and once saw one on a high spruce tree. (I had some doubts whether the larger specimen, No. 118, was not the young of *S. ruber*, but think *not*.)

Red-headed Woodpecker (*Melanerpes erythrocephalus*). I saw a Red-head Woodpecker high on the eastern slope of the Rocky Mountains, but none on the west side.

Lewis' Woodpecker (*M. torquatus*). This bird is quite common at the eastern base of the Rocky Mountains, thus visiting the regions inhabited by its cousin, the Red-head, which does not seem, however, to return the civility. The habits of the two species are very similar, but this species is, perhaps, more of a berry eater and less of a hard worker. I found it much less common on the western slopes of the Rocky Mountains than it is between the Cascade and Coast ranges.

Red-shafted Flicker (*Colaptes Mexicanus*). This Flicker is common throughout the Rocky Mountains, but I noticed none of the hybrid variety common along the Missouri and its branches, which were obtained by Dr. Suckley as far west as Milk river in 1853, and by myself at Fort Laramie.

Chimney Swallow (*Chætura pelasgia?* or *Vauxii?*). I did not notice Chimney Swallows along the lower Missouri,

but near the Great Bend, and at other points above there, as far as the mouth of Milk river, I found large numbers inhabiting old hollow cotton-woods. They seemed smaller and with a whiter throat than *C. pelasgia*, but I did not succeed in shooting any. None occurred west of this point.

NIGHT-HAWK (*Chordeiles Henryi?*). Night-hawks were common all the way across the mountains, until September 18th, when a heavy frost occurred at the Cœur d'Aleñe Mission and drove them south with the Cliff Swallows, which were flying about camp with them on the previous afternoon. Myriads of them flew about, high over the small prairies along Hell Gate river, in the calm warm afternoons, near the end of August, just as the common eastern species does later in the season, and with the same loud cry.

The specimen preserved was shot at Sun river, east of the mountains, August 10th, and I found eggs on the bare ground both at Judith river, June 29th, and near Prickly-pear Creek, August 18th, the latter broken, and with nearly hatched young; probably a second brood.

Specimens of Night-hawks, from both sides of the continent, being "undistinguishable" (Baird's Birds, p. 152), the slight differences in plumage, of the intermediate Rocky Mountain form, seem scarcely enough to separate it, while its habits seem precisely similar. (See Baird's Rep., Pacific R. R. Survey, Vol. IX, App., p. 922.)

BELTED KINGFISHER (*Ceryle Alcyon*). Not seen along the muddy portion of the Missouri, but common from Fort Benton westward.

KINGBIRD (*Tyrannus Carolinensis*). Found at intervals throughout the valleys of the Rocky Mountains, and found also at Fort Vancouver, on the Lower Columbia, in 1853, though it has never been observed in California, and would seem, therefore, to pass to the west coast by this roundabout way.—*To be continued.*

REVIEWS.

Ferns.* — This valuable addition to the library of the student of Ferns, long waited for, and delayed in its first stages of publication by the death of its venerable and learned author,† has been brought out in parts, and at length completed, in accordance with the desire of Sir William Hooker, by Mr. Baker, who has assumed its authorship so far as to add, to the already prepared manuscript, descriptions of new species of Ferns received after that had been written, and to put the whole in condition for publication.

The title of the book, "Synopsis Filicum," conveys the idea of a brief and condensed description and notice of the "known Ferns," and such it is, while it also plays the part of a supplement to the "Species Filicum"‡ of the same author, upon which he was engaged for many years. As the preface tells us, "the Author, having recently completed his 'Species Filicum,' now offers to the public a 'Synopsis of all known Ferns,' which contains, besides brief diagnoses of the species described more in detail in that work, together with their geographical distribution as far as yet ascertained, such additions and corrections as have come to his knowledge * * * *".

One thing to which special reference is made in the preface is, that all descriptions of ferns, which have been so badly or carelessly drawn up that it is impossible to identify which of a number of species a description refers to, and which Pteridologists have, with much labor, and much detriment to true progress in their science, dragged along after them, have been omitted and ignored. This at once reduces very much the number of specific names, and as they are nothing but names, it is a great relief.

The forms considered worthy to rank as species have been somewhat reduced in number by the authors, since they have regarded as varieties numerous plants described by others as species. In much of this we certainly concur, but in some cases should wish to record a difference of opinion. It must be acknowledged, however, that the authors have had the advantage of the largest Fern Herbarium in existence, the formation of which began as far back as 1811, and any one who has handled numerous specimens of ferns cannot but have observed how some forms pass through intermediate stages, into what appear at first to be quite different plants.

*Synopsis Filicum; or a Synopsis of all known Ferns, including the Osmundaceæ, Schizæaceæ, Marattiaceæ, and Ophioglossaceæ (chiefly derived from the Kew Herbarium): Accompanied by figures representing the essential character of each Genus. By the late Sir William Jackson Hooker, K. H., D. C. L., F. R. S., A. S., and L. S., Director of the Royal Gardens of Kew, and John Gilbert Baker, F. L. S., Assistant Curator of the Kew Herbarium. London: Robert Hardwicke, 192 Piccadilly. 1868. 8vo, pp. 482, tt. 11.

†This is the separate work of Sir W. J. Hooker.

‡In 5 vols, 8vo, with three hundred plates representing upwards of five hundred species.

A convenience in the arrangement of the book is the list of the (75) genera, placed under their respective suborders and tribes, which is given at the beginning. The generic characters are given in as few words as is consistent with intelligibility, and the species are described in much the same manner, all the words of frequent use being abbreviated. The greater part of the extensive synonomy, which is often of a complicated character, is left out.* The species of Hymenophyllum and Trichomanes, which have been so much multiplied by certain authors, are here reduced in the ratio of something like two hundred to five hundred. The group of ferns called Phegopteris is here considered as a part of the genus Polypodium. We should much prefer to see the view of the lamented Mettenius adopted, that they are exindusioid Aspidieæ, with which they agree in aspect and other characteristics, and where so many of them have been absorbed by the discovery of an indusium.

The inclusion of the suborders specially mentioned in the title is a great boon, for here we have them, for the first time, comprehensively described.—H. MANN.

THE PAST AND FUTURE OF OUR PLANET.†—The author says, in his preface, that he has freely used the writings of Lyell, Owen, Hall, Dana, etc., "as they had done the writings of others." Now these are the names of men who have grouped the written opinions of others around a nucleus of their own original investigations, whereas Mr. Denton has no such nucleus, the whole being a compilation. As such, however, it will be found of value to the general reader, since it brings together, in a popular manner, the researches which have been made in the geology and palæontology of the United States, and which can only be found elsewhere in Professor Dana's unsurpassed Manual of Geology.

The author adopts without question, the disputed view that the earth is a molten mass covered by a thin crust, in spite of Lyell and Hopkins.

The successive order of the appearance of animals is given as Radiates, Mollusks, Articulates, and Vertebrates, whereas it is well known that the three first appear simultaneously. The Protozoa are wholly ignored and although it is rather too soon to speculate about them, we think the author ought, at least, to have made more than a passing allusion to the important discovery of the Eozoön. Trilobites are said to have no feet, whereas every naturalist supposes that they must have had soft rudimentary appendages, and some have supposed that they made the tracks found in the Potsdam sandstone and elsewhere.

The explanation of the different ages of granite is very apt to mislead the reader into the belief, that the more modern granites have only been formed in the centre, and spouted up in veins through the later rocks, whereas it occurs in masses just as the older granites occur, and not differing except in age.

The illustrations are extremely poor, but the lectures are popular,

* The student is expected to refer to the Species Filicum for that.

† The Past and Future of our Planet. By William Denton. 8vo, pp. 344. Boston, 1868.

likely to interest and please uninstructed minds, and with the exceptions noted, we think are reliable. The chapter on the future of our planet is an imaginative picture of the manner in which mankind may eventually utilize the forces of inorganic nature.

THE FAUNA OF THE GULF STREAM AT GREAT DEPTHS.*—The investigations ordered by the new Superintendent of the Coast Survey, Professor Pierce of Harvard College, into the marine fauna of the Gulf stream, in connection with the regular duties of the survey, have begun to produce its natural result, in such valuable contributions to science, as we have now before us. The line of the present survey was "in a section between Key West and Havana, incidentally with the purpose of sounding out the line for the telegraph cable." Although the work was interrupted, and the casts made with the dredge few, "the interesting fact was disclosed, that animal life exists at great depths, in as great a diversity and as great an abundance, as in shallow water." By two casts in two hundred and seventy fathoms off Havana, Crustacea and Worms, numerous dead shells of Gasteropods and Pteropods, living Terebratulæ, and seven species of Bryozoa, besides Echini, Starfishes, and an abundance of Corals, Hydroids, and Foraminiferæ were taken. Only one species of sea-weed, however, was mixed with this luxuriant animal life, which corresponds with similar results of deep sea dredging in the European seas, and shows that "the greater number of deep sea-animals must be carnivorous." They found, also, that a porous limestone was in process of formation, "composed apparently of the remains of the same animals which were found living." In a cast made in three hundred and fifty fathoms, nothing was brought up but a few dead corals. "The Echinoderms appear to have a wide distribution in depth," and the Gorgonias (sea-fans) are represented in two hundred and seventy fathoms, by at least two species known to belong to the West Indian fauna, in moderate depths. The results of this attempt are certainly very interesting and important to marine zoölogy, although no casts were made in the deepest parts of the channel.

With our present knowledge, it is premature to assume the existence of the higher forms of animal life in the profound abysses of the Atlantic and Pacific Oceans, but dredging in the Gulf of Mexico may be carried to such a depth as to have a most important, if not decisive bearing upon this question, since the Coast Survey have sounded over nine thousand feet in one instance, and several times to the extent of six thousand feet.

Dredging has been very recently carried on at enormous depths by the Scandinavian expedition to Spitzbergen, for it is stated, in the November number of the Annals and Magazine of Natural History, that Messrs. Malmgren and Smitt have dredged up a variety of animals from a depth of 2,000 feet, near Spitzbergen.

THE BUTTERFLIES OF NORTH AMERICA.—The second part of this beautifully illustrated work has appeared, and we desire again to commend

*Bulletin of the Museum of Comparative Zoology. No. 6. Contributions to the Fauna of the Gulf stream at great depths. By L. F. Pourtales, Ass't U. S. Coast Survey.

the fine style in which the work is issued. The colored lithographic plates are unsurpassed, and the letter-press is in every way excellent. We trust the publishers will feel encouraged to continue the work, so that every species of butterfly, together with its caterpillar and chrysalis, in our territory, may set for its portrait. When completed and bound, it will make a beautiful ornament for the centre table. The present number figures various species of Argynnis, Colias, and Apatura. Published by the American Entomological Society, Philadelphia. $2.00 a Part.

Review of the Scandinavian Publications in Natural History during 1867 and part of 1868. By Dr. Lütken of Copenhagen.—Prof. Reinhardt has described two new species and one new genus of fresh-water snakes, *Tachyplotus* (new genus) *Hedemanni* from Billiton and *Helicops assimilis* R., from Lagos Santa, both illustrated by woodcuts. He further gives us the first good figure ever published of the true *Delphinus delphis*, and in a postscript to the observations made by Mr. Hallar, the surgeon of a whaling cruiser, near Iceland in 1867, he demonstrated the identity of the "Strypireydr," of the Icelander, with the little known *Balænoptera Sibbaldii.* The cranium, atlas and os hyoideum of this species of whale are described in detail and figured. Mr. A. Bœck has contributed an interesting paper on two species of truly symmetrical (bilaterally formed) jelly-fishes, related to *Willsia*, but forming a new genus, *Dipleurusoma;* the typical species was observed by the author in the Norwegian Sea; the other is established on a drawing made by the late Mr. Stüwitz, probably in the American part of the Atlantic, near Newfoundland. In another paper Mr. Bœck clears up a question that has considerably puzzled earlier inquirers, in describing the nervous system of *Nemertes*, from his own researches and those of his father (Professor Chr. Bœck in Christiania). He points out the various errors committed by all previous investigators, and demonstrates the composition of the central mass (or brain), which consists of an outer, reddish, granular substance, and an inner yellowish filamentose one (both papers are illustrated by wood-cuts). Professor Steenstrupt's paper on the "Original character of the Terrestrial Mammalian Fauna of Iceland" starts from the hypothesis proposed in Mr. Murray's work on the Geographical Distribution of Mammals, that the field mouse of Iceland might be a species of *Myodes*, and probably one of the American species, thus impressing an American stamp on the primitive fauna of this island; this mammal being in part the *only* one, which, with any degree of probability, can be regarded as aboriginally Irish. He proves that the said mouse is, after all that is known about it, a true *Mus*, closely allied to, if not identical with, the *Mus sylvaticus* of Scandinavia; no single specimen of *Myodes* was ever caught or heard of in Iceland, neither by the author during his stay in that country, nor by others. Mr. Warming, a young botanist lately returned from a three years sojourn in Brazil, in the house of Dr. Lund, at Lagos Santa, has opened a series of "Symbolæ ad Floram Braziliæ centralis cognoscendam." The introduction, illustrated by two physiotyp-

ical plates, is written in Latin, and treats of the *Cordiaceæ*, *Asperifoliæ*, *Voshyriaceæ*, and *Mayaceæ*. Of greater popular interest your reader would no doubt find the same author's "Observations on the Evolution of Heat in a Species of Aroid," made during his stay in Brazil. The description of the new Aroid (Phyllodendron Lundii) is illustrated by a plate. Professor Lange has worked up the *Monotropes* and *Pyroleæ*, collected by Professors Liebmann and Œrsted in Mexico and Central America. The paper is written in Latin, and illustrated with two plates. Professor Œrsted has given an additional note to his former description of the Brazilian Tea-plant (Neea theifera), and described the dimorphous flower of *Halesia tetraptera*, whose minute male flowers have hitherto been unknown; both species are illustrated by woodcuts. I should be inclined to attach considerable importance to the same naturalist's elaborate essay on the Classification of Oaks; after a critical analysis of the labor of his predecessor in this field, and a detailed examination of all parts of their morphology, the author puts forward his own views on the subject, imparting not only a reformed subdivision in genera, subgenera, sections, etc., but also an altered line of demarcation between the *Faginæ* and the *Castaninæ;* so that the numerous (chiefly East Indian) species of *Pasania* and *Cystobalanus* are removed from the true oaks, and referred to the chestnuts. A more detailed abstract of the new facts and views brought forward by Professor Œrsted (whose paper is illustrated by numerous woodcuts, physiotypical figures and two plates) it will be unnecessary to bestow, as the whole paper is reprinted in a French translation as an introduction to the splendid volume shortly to be published by the Royal Academy of Science, under the title, "Chênes de l'Amerique tropicale; Monographiè des espèces nouvelles et peu connues. ouvrage posthume de M. Liebmann, achevè et augmente d'un aperon sur la classification des Chènes en general par A. S. Œrsted"; large folio with many excellent plates; a work that without any recommendation of mine, will excite the high interest of American botanists. Besides the said paper of Mr. Œrsted on the Classification of Oaks, it contains a "Notice sur la vie de Liebmann et specialement sur sou Voyage en Mexique," with a list of his publications, ten plates, with physiotypical figures of leaves, and forty-seven engraved plates, representing species of oaks from tropical America.

In the second volume of the Journal of Botany, published by Dr. Heiberg for the Botanical Society of Copenhagen, you will find several contributions to the Phanerogamic and Cryptogamic (mosses, lichens) Flora of Denmark. Rev. Mr. Lange has contributed a paper on the Mosses of Tuscany; Professor Lange one on the Dimorphous Seeds of *Atriplex hortensis*, and the editor a Monographical and Anatomical Description of *Eleocharis palustris* (with three plates). Among the many interesting verbal communications, of which short abstracts are given in the Bulletin of the meetings of the Society, I shall particularly draw the attention to Dr. Heiberg's valuable report on the Phanerogamic Parasitical Plants of Denmark. Of the venerable Flora Danica, the forty-sixth fascicle has appeared. The editor, Professor Lange, has also published his annual Index Semipum of

the University Botanical Garden. Colonel Jenscen-Tusch has commenced the publication (supported by the Royal Academy of Science) of a work on the popular names of plants in different European languages: the first volume is devoted to the Scandinavian names. As the Journal of Natural History (Prof. Schiödte, editor) is regularly reviewed by a widely distributed English Journal, I shall confine myself to stating that the lately published Part I. and II. of Vol. V, contains two papers, by Dr. Meinert, on Danish Myriapoda (forming, with a former paper by Drs. Meinert and Bergsöe, a complete account of this part of our fauna), and a paper on Duple Spermatic Ducts in Insects (a continuation of his previous contributions to the anatomy of the Earwig). Professor Schiödte's paper on the Manner in which the Position of the Eyes is developed in Flounders (translated in the Annals of Natural History), and finally an elaborate account of the Danish Cladocerous Crustacea, by Mr. P. E. Müller, followed by some very valuable contributions to the knowledge of their propagation (with seven plates). I have no doubt that these two papers belong to the most accomplished essays ever published on this order, whose study is, I believe, almost entirely neglected in America. In the Journal of Fisheries, published by Messrs. Fiedler and Feddensen, Professor Kroyer has announced the occasional occurrence on the shores of Denmark of the Pilchard, and of a new species of Paralepis (*P. Atlanticus*). Mr. Bœck has forwarded the first part of an Essay on the Lobster of Norway, and the history of its fishing. Professor Rasch's address at the International Exhibition of Fisheries, at Bergen in 1865, on Oyster Culture, is reprinted. Finally, I beg leave to observe that in the Journal for Popular Papers on Natural Science, edited by Mr. Fogh and myself (and concluding now its fifteenth year), Mr. Warming has published his "Souvenir," from the Brazilian campos, and described a fine phenomenon, a marine "Ignis fatuus," observed by himself in the Atlantic at 15° Lat. N., and 30° Lon. W., while I have myself endeavored to collect the most important evidences concerning the Mammoth, and the animals exterminated or brought to the verge of extermination through man's intrusion upon nature in historical times. Professor Steenstrupt's paper on the French Bone-caves, and Professor Loven's instructive and elegant address at the meeting of Scandinavian naturalists, in 1863, on the Baltic Sea, are reprinted. Of Professor Reinhardt's most valuable account of the Brazilian Bone-caves, and their animal remains, I have reported in your journal on a former occasion. Of the Proceedings of the Academy of Christiana, only the volume for 1866 has reached me. Professor Sars has described and figured a new species of the arctic genus of fishes, Lycodes (L. gracilis), dredged at great depth in Christianafjord, and continued his examinations of the clay-balls from the glacial epoch. In those described on this occasion he found remains of *Osmerus arcticus*, *Gadus polaris*, and *Cancer pagurus*; in those hitherto found and examined in Norway, he has discovered in all one Pennatulid, one Ophiurid, five Worms (chiefly Chætopods), five Bivalves, five Crustacea, and two Fishes. Professor Sars suggests collecting fuller series of these concretions, which would, no

doubt, give valuable results, and making a special study of them. They have been found hitherto only in Greenland, Canada, and Norway.* Prof. C. Bœck has described in the Proceedings, for 1860, a couple of horns of a hitherto unknown species of buffalo, from Southern Africa, under the name of *Bos longicornis*, and has since that time procured farther evidence about this animal from the Rev. Mr. Schreuder, Bishop of the Norwegian mission in the Zulu territory, who had himself formerly sent the horns to the Museum of Christiania. They were those of a wild buffalo-cow, shot at Eutumeni, and belonging to a troop which suddenly made its appearance in the country, and excited some stir because of their uncommon size and large horns; those of the bull were much greater; the color of the skin was brown. After a stay of some time in the neighborhood of Eutumeni, the troop disappeared from the country and was no more heard of. Probably it was a stray party from a more distant part of Africa, but nevertheless it is singular enough that a peculiar species of wild ox, distinguished alike by its great bulk and extraordinary appearance, and roaming over the plains of South Africa, should have remained totally unknown to the explorers, travellers, and residents of the country; only known in fact from a couple of horns, picked up and sent far away to the most distant University of the other half of the globe! Professor Rasch, the indefatigable fish cultivator, has published the results of some valuable experiments conducted with the view of producing hybrids between different species of *Salmonidæ*. In no class of animals, we are justly told, are there experiments more easily made, and nowhere can it be more easily decided whether the rule of sterility in hybrids is absolute or not. The spawn of the sea-trout, fecundated with the milt of the fresh-water trout, gave an equally high per centage of vigorous brood, as if both parents had been either of the one or the other variety, and the brood itself was not less fertile than if no crossing at all had taken place, thus confirming the views of Dr. Widegren, that the sea-trout and fresh-water trout are only varieties of the same species, an opinion also entertained by Professor Rasch since 1850, when he observed that the brood of the sea-trout, living together with that of the fresh-water trout, was quite undistinguishable from the latter, either in habits or in appearance, as is also the case with that of the great lake-trout of the greater Norwegian lakes, *Salmo ferox* Yarrell (*S. lacustris* Hart.); a fact bearing strongly on the vexed question of species and varieties in the genus of salmons. Spawn of the Alpine trout, or *Salvelin* (S. alpinis), fecundated by the sperm of the common trout, produced from thirty to forty per cent. of well hatched brood, but many were shortly after hatching attacked by a sort of dropsy, and in many embryos the beginning of development was arrested, and they perished by degrees. Spawn of trout fecundated by the milt of the *Salvelin* only gave ten per cent. of brood, whereof some were misshaped. Spawn of true salmon, fecundated by the trout, pro-

* The *Mallotus villosus*, or Capelin, has been found fossil in Gardiner and Saco, Me, enclosed in clay-balls.—Eds.

duced forty per cent. of mostly well-shaped brood, but a part became afterwards dropsical; fecundated by the *Salvelin*, it developed no embryo at all! The spawn of a (presumed) hybrid of the trout and *Salvelin*, fecundated with the milt of a vigorous male trout, also gave quite a negative result. You will agree with me, that experiments of this sort, conducted with the author's skill and profound practical knowledge of the matter, are of a high scientific value. Professor Kjerulf has gathered all the available evidence concerning the earthquake felt over almost all Norway, and from Shetland to Söderhamn, at the Botnio, on the night of May 9th, 1866. The memoir of the celebrated Norwegian geologist abounds with details, allowing of no abstract; I therefore must restrain myself to mentioning that the shock was felt from Bodo (north) to Langesund (south), one hundred and thirty geographical miles, and radiated from a point situated at the south-west of Christiansund, with a velocity of six and two-thirds to seven and three-fifths geographical miles to the minute, but lasted at each spot only two minutes at the utmost. In the later volumes of the Proceedings of the Christiania Academy (known to me only from separate copies of the paper mentioned below, kindly sent to the writer), Mr. Collet has given a full topographical list of the Birds of Norway, summing up their distribution in the country, when and where they were observed, etc. Two hundred and forty-eight species are enumerated. Professor M. Sars has published short notices about some Cœlenterata (coral polyps, jelly fishes, etc.) and Echinodermata (starfishes, etc.), from the Lofoten Isles, i. e., *Thyonidium scabrum* (new species), *Holothuria natans* (new species), *Physophora borealis*, *Corymorpha* (Amathea) *Sarsii* and *Isidella* (new genus) *Lofotensis*. *H. natans* is distinguished by possessing the faculty of swimming, with snake-like motions, in a vertical direction. *Isidella*, a branching coral, was found at the great depth of three hundred fathoms, within the polar circle (68° 11′ lat. north), and is distinguished from *Isis* by its single, unbranched stem, composed of elongated calcareous joints, and very short corneous ones, and fixed to the bottom by "foliaceous radicles." The only complete specimen was eighty millimetres high, and one and a half millimetres thick, but fragments of stems three millimetres thick showed that it grew much larger. Dr. Danielsen has described two species of a new Bryozöon genus, *Kinetoskias*, found at Nordland and Finmarken, remarkable for its faculty of moving voluntarily the branches (connected by a membrane) of its polypary, expanding them in the shape of an umbrella, or closing them together into a ball (according to Dr. Smitt, whose work on the Bryozoa will be referred to afterwards). *Kinetoskias arborescens* D., is a species of *Bugula* (*B. umbrella* Smitt).

Professor Sars has published a little volume of Contributions to the Fauna of the Bay of Christiania, with descriptions and plates of new or little known Crustacea (Crangon, Pasiphaë, etc.). His son, Mr. G. O. Sars, has published a handsome volume, the first part of a careful and detailed description and anatomical "Histoire naturelle des Crustaces d'eau douce de Norvège" (les malacostracés: mysis oculata, Gammarus

neglectus, Pallasea cancelloides, Gammaracanthus loricatus, Pontoporeia affinis, Asellus aquaticus), illustrated with ten highly finished plates; the cost of publication being most generously supplied by Mr. Johnsen, Reviser of the State. From the elder Sars we may soon expect an equally well illustrated description of the remarkable new genus of stalked Crinoids (Rhizocrinus), discovered by his son in the depths of the ocean at Lofoten; and from Mr. A. Bœck, a detailed description of the Norwegian and Arctic Amphipoda, with many plates. The magnificent Geological Chart of Norway, south of the mountain-ridge (der Sönderfieldske Norge or the "stifts" of Hamar, Christiania, and Christianasand), published by Professor Kjerulf and Mr. Tellef Dahll, in ten sheets, large quarto, in the text, and profiles, etc., is the result of many years' explorations by the Geological Survey of Norway, conducted by Professor Kjerulf. Among similar works, it no doubt occupies a high place, as it fills up a great gap in the knowledge of the geological constitution of Europe, contributes considerably to the history of the earliest geological metamorphosis of the globe, and must be reckoned among the highest scientific monuments hitherto erected in Scandinavia. "Norway is now," as said Professor Steenstrupt in his speech at the meeting of the Scandinavian naturalists, this summer in Christiania, "the classical soil, not only of Zoölogy, but also of Geology."

NATURAL HISTORY MISCELLANY.

BOTANY.

We pause a moment before passing to our Botanical Miscellany, to record the sudden death, by consumption, on November 11, 1868, at the early age of twenty-four, of our fellow student and valued friend. HORACE MANN. We had almost looked upon him as our botanical editor, and have been constantly indebted to his accurate botanical knowledge and wise counsels in the editorial management of this magazine.

The country has lost a thoroughly disciplined and scholarly mind, and one of its leading and most promising botanists, and the readers of the *Naturalist* a contributor, whose reviews of botanical works, critical study and identification of their specimens, and unwritten essays promised for its pages, would have both quickened their zeal for the study of Nature, and secured for the botanical portion of the magazine a most elevated character.

THE COLCHICUM AUTUMNALE found growing wild in the wet meadows of the sub-alpine regions of Italy and Switzerland, has been seen in consid-

erable abundance in a meadow not far from the lake of Dublin, N. H., doubtless introduced, but when and how cannot be ascertained. My informant, who kindly brought me some flowers and bulbs on the third of October last, says that there were fifty or more in blossom then, and although having been noticed there for three or four years past, do not seem to have attracted any attention previously.—J. L. R., *Salem.*

THE DOUBLE SAXIFRAGE found in Danvers, Mass., three years ago, and mentioned in the November number of the AMERICAN NATURALIST, was a fortunate "find" of John H. Sears, of that town, an ardent and enthusiastic practical naturalist, whose modesty is as conspicuous as his acuteness of observation. To him I am indebted for a superb specimen of *Polyporus hispidus*, for showing me a locality of the rare little *Moneses uniflora*, and for many similar favors.

As early as May 4th, 1849, some flowers of the *Saxifraga Virginiensis*, all full-double and very beautiful, were brought me while residing at Hingham, Mass., gathered by a young person while "Maying" on the first of the month. My knowledge of the fact connected with this plant thus dates farther back than even Mr. Meehan's, whose idea concerning double flowers is worthy of attention. Semi "full-double" flowers of the *Thalictrum anemenoides*, were found near Cincinnati, Ohio, by my esteemed friend, the late Thomas G. Lee, as early as 1834; and on submitting the plant to a generous culture, in five years' time it produced full-double blossoms."—J. L. R., *Salem.*

VIOLA PEDATA occurs here in two varieties not mentioned in Gray's Botany, viz., white and pink; the former quite frequently. The pink variety is rare. I have only found it once or twice. I have also seen *Pogonia ophioglossoides* purely white. *Plantago prisilla* occurs here, a little east of its range (Gray's Manual, page 269). *Arisæma triphyllum* occasionally has its leaves 5–7, and more, parted.—W. P. BOLLES, *New London.*

RECENT BOTANICAL DISCOVERIES.—Mr. Berkeley opened the proceedings of the Botanical Section of the British Association, with a remarkably interesting address. He directed his remarks, first, to recent researches and speculations in Cryptogamic Botany, on which he is so well qualified to speak judicially, and then to the theory of Pangenesis. He alluded to the observations of DeBary and Cienkowski on organisms which appear to be intermediate between plants and animals, such as Myxomycetes and some forms of Monads, and confirmed the deductions which they drew from their observations. He then noticed Hallier's views as to the fungoid origin of certain diseases. At first Hallier had merely observed fungi in Asiatic cholera, but recently he had stated that in typhus, typhoid, and measles (in the blood), in variola and in vaccinia (in the exanthemes), he had found certain minute organisms which he termed Micrococci, which, when cultivated in the way known to students of moulds, etc., produced each a constant and characteristic fungus. He did not consider that Hallier had proved his case; his experiments were

far from conclusive, and he drew conclusions hastily. It was quite possible that certain fungi might occur constantly in substances of a certain chemical and molecular constitution; but this might be a case of effect instead of cause.

The recent researches of Mr. Herbert Spencer had shown by the introduction of colored fluids into the tissues of the living plant, that the sap not only ascends by the vascular tissue of plants, but that the same tissue returns and distributes the sap after it has been modified in the leaves. — *Quarterly Journal of Science, London.*

CUBAN PLANTS FOR SALE. — I have made thirteen (13) sets. The largest one contains two thousand two hundred and fifty three (2,253) species or well marked varieties. The others diminish pretty regularly to the last, which has but six hundred and thirty seven (637) species. My collections have always sold at ten dollars per hundred when our money was gold and silver, but I am willing to take the same amount now in currency. The larger sets give a very fair idea of the Cuban flora, and are fuller than any other collection of Cuban plants except three, — that of the Herbarium at Cambridge, Mass., that of the Kew Gardens, England, and one belonging to Mr. Sauvalle, of Havana. — CHARLES WRIGHT, *Cambridge, Mass.*

BOTANICAL NOTES. — I observe frequent notices of plants in the NATURALIST which produce white flowers. I have collected specimens of a white variety of *Mimulus ringens** for a number of years, which adds another to the list of albinos. Last season I detected *Nuphar Kalmiana* with two kinds of leaves, the usual floating ones, and another set of submerged ones, which were very thin, and when dry almost transparent. Are those submerged leaves usually found with the plant?† We have a Rubus in this vicinity which seems to be a connecting link between *R. strigosus* and *occidentalis*.‡ Has *Myozurus minimus* ever been found east of Pennsylvania, in the United States? I collect it here at Belleville.§ — JOHN MACOUN, *Belleville, Canada.*

[Brief botanical notes would be welcome to the NATURALIST, and we should print the most useful. — EDS.]

HEPATICA TRILOBA. — Some authors speak of a variety with five-lobed leaves. Now I think the five-lobed leaves are not the true leaves, but changed flower buds. I have some of the plants under cultivation, and frequently the bunches push up leaves (such as I send you) with five lobes. These bunches do not bear flowers, the five-lobed leaves appearing with the flowers of the other bunches, and the true leaves afterwards, coming out simultaneous with the leaves of the flowering plants.

*There is a white var. of almost everything, even of the Cardinal flower. I think I never heard of it in the Mimulus. — A. G.

†Always in this and the ordinary *N. luteum* of Europe, etc.; very rare in *N. advena*. See Gray's Manual of Botany, revised edition, page 57. — A. G.

‡Is not this *R. occidentalis*, with white or amber colored berries? Grows in Vermont. See Gray's Manual, page 157. — A. G.

§The farthest east known, if wild. It may have come direct from Europe. — A. G.

While travelling in the Grand Traverse region of Northern Michigan last May, I observed, growing in the beech and maple woods, plants of *Trillium erythrocarpum*, which were fair representatives of metamorphosed plants. The petioles much elongated (2′–4′); leaves very large and distorted; sepals leaf-like, raised on petioles an inch or more long. The petals likewise leaf-like, colored green, with a few white lines. Even the stamens and pistils were colored green, and all vestige of the flowers had disappeared. I was so situated as to be unable to preserve any of the specimens I found. I also found *Uvularia perfoliata* Linn., bearing two, three, and even four flowers upon a single plant, which I believe to be as uncommon.—R. H. FISHER, *Mt. Etna, Ind.*

ZOÖLOGY.

THE MCNIEL EXPEDITION.—In the November NATURALIST a short notice was given of Mr. McNiel's expedition to Central America. After about five months work in the field, and the expenditure of about all his funds, Mr. McNiel availed himself of the great liberality of the Panama Railroad Company, and Pacific Mail Steamship Company, to return home with his collections, free of cost, in order to refit and consult in regard to more extended operations, which the knowledge he had derived during his trip seemed to make most desirable. The plan is now for him to return to Nicaragua, accompanied with an assistant and competent collector and taxidermist, in the person of Mr. Walker, a student of the Peabody Academy of Science, provided about $3000 can be secured for the purpose.

The many acts of kindness received by Mr. McNiel from the officers of the Panama Railroad and Pacific Mail Steamship Companies, and their generosity, expressed in the substantial form of free passes and free transportation of materials, and the hospitality and kindly assistance received and proffered from Don J. J. and Capt. F. B. De Shon, Mr. Nelson, Mr. Sternburgh, Col. Haratzthy, Capt. Douglass, and others; and the interest in his labors and aid extended by the official authorities, secures a decided success to the continuation of the expedition: and with the assistance of Mr. Walker, who will more especially devote himself to the collecting of birds and mammals, large and valuable results are looked for with a certainty of fulfilment. It is proposed to return Mr. McNiel back to his field of work in a few weeks, so as to take full advantage of the dry season, which is far more conducive to collecting than the rainy one in which most of his collections thus far have been made. On his return, special attention will be given to archæological and ethnological matters, as well as zoölogical, and interesting results are looked for in these researches.

Among the specimens brought home by Mr. McNiel, consisting of corals, shells (marine, fresh water, and land), insects (including a large number of butterflies, beetles, and tarantulas), fishes, reptiles (including

a large living rattlesnake), and a few mammals, were two large stone pans and a "masher," discovered on the island of Corinto, on the Pacific coast of Nicaragua, having been washed out of the sand by a late heavy rain. These "pans" are very interesting, in showing that the same kind of utensils and implements of stone were in use by a forgotten race, as those now in common use by the natives of the interior of Nicaragua; for though there is no doubt of the great antiquity of the implements found on the island, yet stone "pans" of the same shape were seen by Mr. McNiel in use by the natives, for the purpose of preparing a coarse food by mashing hulled corn on the pan by means of a nearly cylindrical stone, held in both hands and used as a "masher." This fact is doubly interesting to us, as there are in the Museum of the Academy stones of similar shape, found in various parts of New England, that were undoubtedly used for an identical or very similar purpose by the aborigines of our own land.

To Col. A. Haratzthy, of Corinto, the Ethnological collection of the Academy is indebted for a most unique and ancient pair of enormous stirrups made of wood, elaborately carved, and bound with iron; and to the Messrs. De Shon, for an ancient rapier, bearing the maker's stamp of "Lisbon, 1621."

Capt. A. T. Douglass also sent an addition to our live stock, by Mr. McNiel, in the form of a most mischievous and interesting little animal, about the size of a cat, combining the mischievousness of a monkey with habits between a bear and raccoon, who, since his instalment at the Academy, has evinced a decided affection for the cat and a most manifest desire to ascertain the nature of the contents of every box and bottle in the room, and has proved to us that he is a good observer of objects of nature, if not a very discriminating naturalist. The Nicaraguan name of this interesting little fellow is "Pisota." In South America, two or three closely allied species of the genus are generally known under the name of "Coati."

As stated in the November NATURALIST, the continuance of the expedition depends on the disposal of duplicate specimens to various parties, and it is hoped that individuals and institutions wishing to have collections in the various departments, will at once send their subscriptions to the expedition fund, and state the character of the specimens they wish in return. A large number of specimens are now nearly ready to be distributed to subscribers, and there are plenty of most of the species to furnish good suites to all who apply soon. Subscriptions will be received in sums of $100 and upwards, but the larger the subscription the more satisfactory will it be to both parties, as the division of the specimens can then be carried on with less trouble and expense than if made up into small lots, and the subscriber will receive a proportionally greater number of specimens, unless only some special class of specimens is required by the subscriber.

For further information regarding the expedition, address F. W. PUTNAM, *Director P. A. S.*

Ambergris.—I find in the American Cyclopedia the following account: "It is a morbid secretion of the liver of the Spermaceti Whale, found floating on the sea, sometimes on shore; it is found in the intestines of diseased whales." In 1842, the bark Spartan, from this port, killed a sperm whale that was exceedingly lean; on cutting into the whale, the lower portion of the intestine was cut off, and some small balls floated out, but only a very small portion of it was saved. In 1862, the schooner Estella, of this port, killed a lean sperm whale, from which they took sixty-six pounds of ambergris, which, on the arrival of the vessel, sold for $64 per pound. On another voyage, in the following year, the same schooner captured a whale, from which they took twenty-three pounds nine ounces, which sold for $70 per pound. Last spring a very lean whale was killed by the schooner Watchman in the West Indian seas, from which was taken thirty-eight pounds fifteen ounces of ambergris, which sold for $90 per pound, amounting to $3,504.37. These cases are all that I have found where whalers have been fortunate enough to find ambergris in whales. There is no doubt that they sometimes let carcases go that contain more value in the intestines than the whole blubber is worth. This substance, accumulating in the intestines, causes a stoppage so that nothing can pass from them; in this condition they cannot live long. I have seen sperm whales on the water that had been dead so long that the blubber was spoiled. If such die from a secretion of ambergris they would contain a large amount of that valuable substance, and it would pay well for the trouble of taking in all whales met with on the water, if the cause of their death is unknown.

The food of the sperm whale is mostly the large squid; it is the opinion of some of our whalers that the bills (a specimen of which I presented to the Essex Institute not long since) are not digested in the stomach of whales, but pass down the intestines until they come near the vent, where they accumulate and finally cause a stoppage. This they infer from the fact that they find these bills (as they call them) with the ambergris.—N. E. Atwood, *Provincetown, Mass.*

Moulting of the Shrimp (*Mysis*).—I enclose a few Shrimp "moults," whereof the most enormous quantity drifted ashore on Thursday, August 13, 1868. They were left by the tide in windrows, at the mouth of the river, and along the beaches for miles. I picked up a handful, and send the enclosed as of possible interest. They seemed all nearly of a size, and probably, therefore, of a uniform age. I was not aware before that the reticulated cornea of the eye was shed with the skeleton, and possibly others share my ignorance.—W. C. Johnson, *Newburyport, Mass.*

Nest of the Belted Kingfisher.—I notice from articles in the September and June numbers relating to the Belted Kingfisher, that Mr. Endicott and Mr. Wood disagree. I agree with the latter gentleman in saying that I have always found the holes from four to six feet in depth, and *never to the depth of eight feet*, as Mr. Endicott says, and with the exception of two cases, both of which occurred in clay banks, straight in

the direction in which they start. Mr. Endicott asks if any one have ever known them to turn to the left? In answer to his enquiry, I would like to have it distinctly understood, that in both the cases mentioned above, *the holes turned to the left*. I have sometimes found a nest of grass and sticks, but not usually. Mr. Wood says the eggs are about seven in number. I have found as many as eleven eggs in a nest, but never more than that.—C. E. WILLIAMS, *Utica, N. Y.*

GEOLOGY.

THE IOWA DRIFT.—Since my announcement at the late meeting of the American Association for the Advancement of Science, at Chicago, of having traced up to their original ledges in North-western Iowa, and the adjacent parts of Dakota and Minnesota, the red quartzite boulders of the drift of Western Iowa, I have had the additional pleasure of following up, to its original home, much of the granite also, which is profusely scattered in the Iowa drift.

These observations of granite *in situ*, were confined to the immediate vicinity of the Minnesota river, and indeed to the bottom of its valley alone, but extending a distance of about thirty miles, being from a point a few miles below Fort Ridgley, to the mouth of the Red-wood river. These rocks, although evidently belonging to one continuous mass, are quite variable in texture and proportions of composition, even within a short distance. The prevailing color is reddish, from the great preponderance of feldspar of that color. Hornblende is always present, and sometimes preponderating to such an extent that limited portions have the characteristics of hornblendic slate. Mica is not always discernible, but can usually be detected. The quartz is mostly in small granular crystals, and is evidently the origin of a portion of the drift sands of that region. Indistinct lines of stratification can often be seen in these rocks, and they not unfrequently present the characters of gneiss. The rocks are found in place only in the river valley, for the reason that the whole region is covered deeply with drift, with a prairie surface, having a very distinct general level, down from which the river has eroded its valley during the unnumbered post-glacial centuries, down to these underlying rocks. The valley now presents the appearance of a huge, well-defined, slightly tortuous ditch, about a mile wide, and something more than one hundred feet deep. Thus, as one travels over the prairie surface of the region, he sees nothing of these rocks *in situ*, but in the bottom of the valley he finds frequent large exposures of granitic rocks as characteristic as those of New England. As might be inferred from the great preponderance of feldspar and hornblende, these rocks readily disintegrate, much more so in fact than common limestone, and at the mouth of the Red-wood there are large exposures of them, reaching a hundred feet in thickness, yet in place and undisturbed, but so thoroughly decomposed, that one can crush it in his hand to the condition of ordinary soil, like that described by Professor Agassiz, as composing the Organ mountains,

near Rio Janeiro. It is evidently from this source that much of the soil and fine material of the drift of Iowa and Minnesota are derived. New England did not derive such a soil from her granites, although they contain all the elements of good soil, because their texture did not allow of their ready disintegration, while the glaciers were passing over them, as those of Minnesota did. Thus the great superiority of the soil of the North-west over that of New England, is due to the fact that the rocks of the whole region—granites, sandstones and limestones—were more easily disintegrated and ground.—C. A. WHITE.

ANSWERS TO CORRESPONDENTS.

W. C. F., Eastham, Mass.—The "silver witches," which you say is the common name for them with you, is probably the *Lepisma saccharina* Linn. It is found in damp houses, in closets, among books, and is injurious to silks and silken tapestry, we are informed by a lady living in Salem. You write "that they seem to choose the darkness, and move from one room to another by night. A wicker basket, that had been laid aside for some time, was found to contain quite a population of them. Hundreds were scalded out of it. I send one or two pieces from the basket, showing their work." We are surprised to find the Lepisma accused of doing damage by boring into wood-work, not suspecting an insect, with such a flattened and weak body, capable of boring cylindrical holes in soft wood, though it has powerful jaws.

————, Portsmouth, N. H.—In answer to your query whether the Greenland Saxifraga is a variety of S. Pensylvanica, we would say that we cannot guess at Greenland or any other Saxifrages (or any other plants at all for that matter); there are too many of them to make it a profitable employment.

L. A. M., Glen Falls, N. Y.—The caterpillars are the young of *Papilio Asterias*, the Parsnip Butterfly. The v-shaped horns thrown out from behind the head, are supposed to be organs of protection.

L. B. C., Richmond, Ind., writes that "on Monday, the 27th of April, 1868, the children found a Luna-moth (*Tropæa Luna*) under a beech tree. They brought it in, and I placed it under a glass disk, with beach, maple, and currant leaves, neither of which, however, did it eat; but on Thursday night, April 30th, it broke the point off from one of its wings, and eat it up. Friday night, May 1st, it broke off the other point and commenced devouring it, but I soon found it at its work of self-destruction and killed it. During its captivity of five days, it eat none of the leaves placed in its prison fresh, and when I killed it, it appeared as active as though it had a plenty of its favorite food. Is it natural for them to destroy themselves if kept in confinement? Or was it for want of its natural food? And what is its natural food?"

The Luna and other moths of the Silk-worm family (Bombycidæ) do not eat or take food except in the larva state, as the mouth-parts (tongue and mandibles) are aborted. Nearly all moths suck in the nectar of flowers and other sweets, but never use their jaws, which are obsolete, though well developed in the caterpillar. Did not your Luna break off her tail, and did not the fragment disappear in some other way than down her throat, which in the winged state is not adapted for swallowing, as she only lives long enough to go through a brief courtship and lay her eggs for her future progeny, taking no food during the few days of her moth-hood. The caterpillar feeds on the maple and other trees.

BOOKS RECEIVED.

Observations on the Metamorphosis of Siredon into Amblystoma. By Prof. O. C. Marsh. With a plate. New Haven, 1868. 8vo, pp. 12.

Outlines of Comparative Anatomy and Medical Zoölogy. By Harrison Allen, M. D. Philadelphia, 1869. 8vo, pp. 190.

The Canadian Entomologist. Vol. I, No. 4. November, 1868.

The Field. October 3 to November 21. London.

Synopsis of the Birds of South Carolina. By Elliott Coues, M. D. Boston, 1868. 8vo, pp. 23.

American Bee Journal. December, 1868. Washington, D. C.

Report on the Trials of Plows, held at Utica. Albany, 1868. 8vo.

Land and Water. August 8 to October 31, 1868. London.

Some Recent Additions to the Fauna of California. By J. G. Cooper, M. D. (From the Proceedings of the California Academy of Science, January, 1868.) 8vo, pp. 11.

Cosmos. October 3 to November 14, 1868. Paris.

THE

AMERICAN NATURALIST.

Vol. II.—FEBRUARY, 1869.—No. 12.

ABOUT SHELLS.

BY CHARLES WRIGHT.

In the course of my herborizations in Cuba, I have had frequent occasion to climb trees for flowers which I could not otherwise obtain, and much more frequent occasion to clamber about the limestone cliffs which furnish a great variety of plants, many of which are common in such localities, and are found nowhere else. In these circumstances, it was hardly possible that my attention should not be drawn to the shells, some inhabiting trees, and many more the rocks. I came, in truth, to be very fond of them, spending many hours entirely devoted to shell hunting, which, I begin to think, I could have spent more profitably in my legitimate calling. I propose to relate some of my observations, and to give my views as to the causes of some of the phenomena observed, hoping that they who make this branch of the animal kingdom a special study, may be prompted to investigate these phenomena more minutely than I had time or ability to do.

Shells have a season of hibernation in hot climates as well as in cold; but, in the former, the cause of their inactivity is dryness; in the latter, low temperature. If the drought be protracted, the greater part seek a retreat where

Entered according to Act of Congress, in the year 1868, by the PEABODY ACADEMY OF SCIENCE, in the Clerk's Office of the District Court of the District of Massachusetts.

some degree of moisture prevails; for example, in the ground or among the dead leaves covering it; in a hollow tree or in the crevices of the bark; under stones or among the leaves of epiphitic Tillandsias. But occasionally an individual is found abroad at this season, and repeated examination led me to discover *a* reason for it; whether it is *the* reason, may remain for wiser ones to determine. These shells are commonly stuck fast where they are found, or glued as it were, and not merely adhering as in a time of rest in the wet season. And they have all been injured,—the shell more or less broken. Are they going to die? Are they undergoing repairs? This last seemed to me more probable. They *are* always, in part at least, grown together, not quite symmetrically often, but generally quite firmly. Do they eat by night as in the rainy season? This I cannot assert. The firmness of their attachment would indicate that they do not. So uniform has been my experience in this case, that now, if I see an Achatina, or a large Helicina, on a tree in the dry season, however inviting they may appear at a distance, I pass them by as worthless.

Oleacina and its allies are carnivorous snails. They have a smooth polished delicate shell, yet possess the power to capture and devour others many times larger than themselves, besides being protected by a firm shell, and with a closely fitting hard operculum. Not unfrequently we find large shells like *Helicina regina*, or *H. sagræana*, quietly submitting to be devoured by an Oleacina, which it has the strength to walk off with, as easily as a tortoise could carry away a mouse. Wherein lies their great strength? I can offer a suggestion. I have often been in such situations on the face of a vertical cliff, that I needed both hands for support. At such times, if a shell attracted my attention, I used to put it between my lips till I reached a place where both hands were free. Thus I learned, that the watery or slimy secretion which all these animals emit, in the case of this group, is bitter; and in the larger species, very deci-

dedly so. I can hardly doubt that the secret of the power which these snails possess is to be sought here. May not this bitterness produce a benumbing effect on their prey? I have discovered a like bitterness in no other shell, and I have collected many species in this way, using my mouth as a temporary box.

Proserpina has a shell of like delicate structure as that of Oleacina. Once I found one in close contact with a Melaniella. This, together with its structure, led me to suspect that it, too, is carnivorous. Who knows? Will an examination of the tongue tell? Will some one try it? I once amused myself capsizing these little fellows, and if they did not manifest real anger, there was a very good imitation of it. Turned on its back, it lashed its tail about violently for a snail; or I might say it behaved mulishly and kicked,—the organ thus forcibly used being called the foot, I believe. The inverted position seemed a painful or disagreeable one.

I hesitate to record an observation repeatedly made on account of the apparent improbability of the fact, and the difficulty of explaining it. Individuals of some species of shells many times vary greatly in size as well as in color. In other species, the said variations are slight. In one or more species of Cyclostoma of this latter kind, I have often found young individuals considerably larger than any fully grown. There could be no shadow of a doubt that these were all of the same species, and not two distinct ones living together. Among a dozen or two fully formed shells and others nearly grown, all agreeing well in size, one, perhaps two or more, incomplete individuals would occur, so much larger than all the rest, as to suggest the question,—*Why do we not find finished shells of this larger size?*

Two solutions of this question have presented themselves as possible, though neither of them is quite satisfactory. One is, that the animal has power to absorb its shell and reconstruct it of a smaller size. The other, which seems more probable, is, that these overgrown individuals are abnor-

mal, deformed, and never come to perfection. Thus, being thin and fragile, they soon crumble and disappear. I have thought that I found proof or evidence that mollusks *have* power to absorb and reform the shell. From Melania and Paludina, which are viviparous, I used to preserve the young found in the process of cleaning the shells. Observing that they were quite blunt at the apex, and that somehow in their growth toward maturity they became sharp-pointed, I could in no other way account for this than by supposing that they absorbed the shell, and reconstructed it after a smaller pattern. I will admit, for what it is worth, the possibility of inaccuracy in my observations when comparing small things with great. Thus, a very short cone might appear blunt, while, if increased tenfold, the bluntness would be, relatively, quite little. Yet this view does not satisfy me, and I still think my first impressions were correct. Will not some one by accurate measurements settle this question?

On the beach to the eastward of Matanzas the habits of a Cyclostoma struck me as noteworthy. A hundred yards or more from the shore, the ridge formed of sand and broken shells is overgrown with various trees and bushes, which this shell ascends probably to feed on some lichen. But if the tree leaned at any considerable angle, say twenty-five or thirty degrees, no shell could be found on it. And of the bushes, too, it had its choice as to size, also. None seemed to venture up a bush, or there was no attraction for them, if it were not larger than the finger or thumb. It may very well be, that on the small bushes they found nothing to eat; but the same reason cannot be given for their refusal to ascend larger leaning ones.

It has been said above, that in winter shells mostly lie dormant, not on account of the cold, but of the dryness. But if, at this season, a heavy shower occurs, which is not very unusual, they come out of their hiding places and appear to be feeding; not, indeed, in such numbers as during the summer, for already many are dead. Now, let a

norther, which is a drying wind, spring up, and they haste away to their retreats with all possible speed. Such a shower occurred on a winter night when I was in the neighborhood of Guane, where there are excellent rocks for shells, and many and various shells among the rocks. Early in the morning I found some specimens of *Melaniella Pichardi*. They were not abundant, though I saved a considerable number, and was desirous of collecting more of them, as it is, by no means, common. While I was at breakfast, a light norther began blowing. I made but little stay, and returned to the rocks, in hopes, though not confident, of finding more. Not one was to be seen, however. Similar effects are produced by a norther on other shells. Just at night I have observed *Cyclostoma salebrosum*, in numbers, on rocks, where, in the morning, if a norther prevailed during the night, not one could be found but by searching among the leaves at the base of the rocks. This shell, with some others, as *Cycl. rotundatum* and *Cycl. undatum*, have a way of letting go and rolling to the bottom of the rock if it be inclined (and they seem to prefer such), when they see the hand approaching; and this, apparently, when they have not even *one* eye open. It would seem as if they felt the approach of danger.

A group of Cyclostomas, *C. claudicans* Poey, *C. assimile* Gundl., *C. tenebrosum* Mor., and perhaps others, spin a thread by which they hang from the lower side of projecting rocks. When the weather clears after a rain, numbers may be found thus at rest, particularly in the early summer, when the young abound. Whether they can haul in their line I am unable to say, but guess they cannot; for many are found with the border broken, which could hardly be so common, unless caused by a fall from some height. If in this position they fall, it must sometimes be a distance of fifty, or, it may be hundreds of feet. These are all thin, delicate shells; and the power of suspension seems as if designed for their injury or destruction.

Helix stigmatica, and its allies, live under stones or among dead leaves. They are dull in color, and the most of them small in size. H. stigmatica is never found fairly in the daylight. Once only, if I rightly remember, I found an individual which had just turned the corner of the rock under which it lived. Why do they not come out to the light, and what do they live upon in their dark retreats? Another group, of similar habits, comprises *Helix Titanica*, *H. pulcherrima* and others. These have longitudinal lines of bristles, or rather stiff hairs, which are quite conspicuous in the young shell, but diminish, wear away, or quite disappear with age.

Shells often cease growing for a time, so far at least as relates to their calcareous covering. Their growth is interrupted during the dry season, and it may also be by an unusually dry time in summer. In banded shells, when the growth is resumed, the pattern of their markings is often, perhaps always, changed. The bands may be moved to the right or left, or be divided into two, or two may be united, or a color may be suppressed, or a new one introduced, or any one color may be widened or narrowed. In *Helix picta* Born., the variety of markings is almost innumerable. While the animal remained quiescent as a whole, why did not the several parts retain their relative positions? The color-secreting glands must have changed in position.

The wide diffusion of some species, and the extremely limited area in which others are found, excite in the inquiring mind a desire to know the causes of this unequal distribution. *Helix regina* in several forms is found in the whole of the mountain range of the western part of the island. *Helicina adspersa* is another extensively diffused species, besides being very variable in size and markings. On the other hand, *Cyclostoma foveatum* has been found only in one locality, at the base of a high projecting cliff, in considerable numbers, but all dead; nor is it known where it lives. I have looked upwards from below, and have climbed to the top and looked downwards in vain. Not more than two or

three have been obtained in a moribund state,—a single one only with sufficient life to enable Gundlach to describe and figure the animal. A few square yards contain all we know of this species. *Achatina fasciata* is found from one end of the island to the other, and at all elevations above the sea, under several forms which have been described as distinct species. *Helix picta* Born. is another widely diffused shell, and extremely variable in color and size. I have observed many young in the top branches of a high tree just felled, on the very top of the mountains, in Yateras. It seems to be a high climber, which may account for its comparative rarity, fully grown and alive. I have met with very few.

Cylindrella is largely represented in Cuba, more than eighty species being enumerated in the latest catalogue. Most of the species are extremely local; several, so far as is now known, being restricted to localities of a few yards square, or to a few rods. Doubless other localities will be discovered for many of them. A few, as *C. Poeyana*, *C. elegans* and *C. irrorata*, are much more widely spread, but probably not one extends through the whole island as does *Achatina fasciata*. But what is most noteworthy is the remarkable tenacity of life possessed by many species. Some have lived for months, and even years; and, unless closely confined, they will crawl forth on the return of warm, damp spells of weather, getting into the wrong boxes and creating sad confusion.

THE SMALLER FUNGI.

BY JOHN L. RUSSELL.

[Concluded from page 570.]

Another point of interest worthy the attention of the observer, and furnishing subject matter for the microscope, is a sort of dimorphism,* and even something like alternate generations such as is observed in the lower animals. We

* *Dimorphism*, two shapes or forms.

have seen that the spermogones which accompany the cluster-cups in the *Æcidium*, for instance, seem to have some intimate relation to them. There is another kind of the smaller fungi which, attacking grain, is known as *Rust*, and in science is called *Uredo*. But besides the *U. rubigo*, or Rust, on the grasses and grain, Dr. Curtis enumerates twenty-eight other species which attack other plants, and which have come under his observation. In other sections of the United States other species are found, and on the cultivated roses of the gardens, an European species, the *Uredo rosæ*, has fallen under my notice. Of this particular kind of Rust, our author says, "in the Uredines as well as other of the Coniomycetes (in which the spores are the principal features), the same fungus appears under two or more distinct forms, not necessarily mere differences of age, but so distinct that they have been regarded (and some are so still) as different species belonging to different genera, often far removed from each other, and bearing different names. One plant (fungus), for instance, sprinkled over the under surface of a rose-leaf, like tumeric powder, has its mycelium, or root-like threads, penetrating the tissue, whilst bearing above its spherical golden colored spores. Its vegetative system is complete, and apparently its reproductive also: hence it seems to claim recognition as a perfect plant, and under the name of *Uredo rosæ* was so recognized, until microscopical investigation determined otherwise. Thus, it has been discovered that certain dark brown spots which appear later in the season, are produced upon the same mycelium, and are indeed, aggregations of more perfect and complex fruits of the same plant. Before this point was satisfactorily decided, the brown spores, which are borne on long stalks and are themselves septate, or divided by transverse partitions into a complex fruit, received the name of *Puccinia rosæ*. At this period *Uredo rosæ* and *Puccinia rosæ*, or the yellow fungus and the dark brown fungus, were believed to be distinct and different plants; now, on the contrary, they are believed to

be different forms of fruit produced by the same plant, *i. e.*, an instance of dimorphism."

A similar instance of this two-formed condition of the smaller fungi can be traced in the delicate mouldiness which covers the leaves of many plants, as the lilac, the grape, and the fruit of the gooseberry, and looks like strings of beads made of colorless cells, in this condition known or described as *Oidium* (Fig. 1; *a*, tuft of conidia of *O. monilioides* × 120; *b*, portion of grass-leaf with the same species of blight. From Cooke), the spores being the self-same beads, and egg-shaped or oviform, whence the generic name; but careful observation will persuade us that this is not the perfect condition; and when later in autumn these threads become more compact, and are surmounted on their horizontal surfaces by shining black capsules, or perithecia, each of which is filled with elegant elliptical and elongated cells, and each in turn containing several spores, shall we find in *Erisyphe* that we have arrived at the conclusion of the dimorphism of this fungus, a parasite and injurious in its effects. The famous grape mildew, so destructive to the foliage of the wine and table grapes of Europe, and known as *Oidium Tuckeri*, is thus only an imperfect form of some common *Erisyphe*, or mildew; and in this portion of Massachusetts, so far as I have observed, it is the *Uncinula spiralis* (B. and C.) which attacked the foliage of the sweet water grapes, as on vines of Mr. E. S. Rogers of Salem, in 1850, and the same parasitic fungus which covered the leaves of the wild grape, Isabella, and other hardy varieties, and which can be detected every season to a greater or less extent.

Fig. 1.

And besides this dimorphism thus apparent in the smaller fungi, stranger facts connected with their natural history meet us here. Observation has detected in the Æcidium, or cluster-cups, not a perfect fungus as it would seem, but in

them only a condition of some other fungus! Thus the genus *Uromyces* contains several distinct kinds of minute fungi, of which, for example, we will select the bean-leaf rust (*U. appendiculata*), which consists of brown dusty spots, resulting from clusters of spores not enclosed in any pustule, excrescence or peridium. Each of these spores will be found to be furnished with a tiny footstalk, and by means of which they are attached to the living leaf of the bean. The spore itself is unilocular, oboval in shape, terminated by a rounded point, having two distinct coverings, the outer of a deep brown color and smooth, the inner colorless; these enclose a granular matter surrounding a vacant and rounded spot, and having at the top a minute opening. These spores are ripe towards the end of summer, and in harvesting the crop, the brown and snuff-like powder will readily part from the dead foliage, and from the pods, and smut the fingers. Like the seeds of the higher plants they await the return of spring, when, if having fallen upon humid soil, "the spore emits a curved and obtuse tube, which, soon ceasing to elongate itself, gives origin to three or four sporidia, of a kidney shape." If the sporidia should fall upon a living bean-plant, the tube "on being emitted penetrates the wall of any approximate cellule, swells and increases into a cylindrical tube equal in thickness to the original sporidia, and therefore four or five times the diameter of the germ-tube before it entered the cellule. The contents of the sporidia and external portion of the tube pass into the portion within the cellule, and then these external portions perish, and all evidence of the entry is obliterated, except a very minute point at which the tube remains attached to the inner surface of the wall of the cellule. The enclosed tube soon elongates, divides, and becomes branched. These branches pass into the spaces of the pulp of the leaf and become mycelium, a change which takes place in a few hours. Where the sporidia had fallen on the surface of the bean-leaf, little white spots soon appear, and presently little

orange protuberances, many of them surmounted by a little drop of mucilaginous fluid. These are *spermogones*, daily increasing in number, and soon after numerous large globular protuberances intermingle with them. These soon rupture the skin of the leaf, and take the orange color and the form of cluster-cups, *Æcidium*. At length the summit of the peridia opens to allow the escape of the stylospores.*

It is easy to assure oneself that the spermogones and the cluster-cups proceed from the same mycelium, and for some time to come the peridia of the *Æcidium* continue to increase, till at length brownish or blackish points make their appearance, intermingled with the cluster-cups, increasing rapidly in number and magnitude. Examined by the microscope they present the ordinary fructification of *Uromyces* mingled with stylospores. Thus the mycelium of the cluster-cups engenders, at the end of its vegetation, fruits equal in all points to those from whence, in the first instance, they are derived. These stylospores found in the cluster-cups possess the irregular globular form and structure of their congeners. If they should be sown on the moistened epidermis (skin or cuticle) of a favorable plant, the sprouting or germ-tube at first creeps along the surface, but as soon as its extremities find a stomate,† it enters it, and elongates itself in the air-cavity‡ below the orifice, receives the contents of the original stylospore and exposed portion of its tube, then separates itself from those parts which become dispersed. The active part increases and ramifies, and produces a mycelium which spreads through the intercellular passages of the parenchyma (pulp). Whitish spots subsequently appear on the surface of the fostering plant, and indicate that the fructification of the parasite is about to commence. The epidermis is elevated and broken, and little brown pustules appear through the openings. These are the stylo-

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**Stylospores*, a second kind of spores borne on long threads, enclosed in a peridium or appropriate pustule.

†*Stomate*, breathing-pore of the leaf. ‡Air-cavity, a space in the pulp of the leaf.

spores of *Uredo*, which are produced in immense quantities, and soon cover the pustules with a deep brown dust. Later, the formation of the stylospores is arrested, and the true germinating spores appear in the same pustules.

The stylospores of *Uredo* are borne singly at the top of short filaments. On arriving at maturity they detach themselves. They are of a globular form, with a reddish brown epispore (covering), provided with little pointed prominences, and three pores at equal distances. After maturity they germinate in precisely the same manner as the stylospores of the cluster-cups. They enter only through the stomata of the epidermis (skin of the leaf). The pulvinules (clusters of powdery spores) are identical with those which the stylospores of *Æcidium* originate, and they also produce true spores at the end of their vegetation. No other fruit arises from them. These organs, therefore, always reproduce the same form to which they owe their origin.

The result of these investigations shows that the Bean Rust (*Uromyces appendiculata*), besides spermogones, possess four sorts of reproductive organs, which all serve to propagate the species, but that one alone of them produces it in a form always identical, while the others present well marked *alternations of generations*. Hence it is concluded that there are, first, *Spores*, which produce the germinating promycelium;* second, *Sporidia*,—these give place to a mycelium, which bears afterwards; third, *Æcidium* (a condition which exhibits),—particular organs which engender stylospores, and which produce, fourth, the *Uredo*, or a second form of the stylospores and later spores (No. 1), which are always associated with Uredo in the same pustule. The spores and stylospores of *Uredo* come also upon the old mycelium, which had previously produced *Æcidium*. The Uredo stylospores always produce *Uredo* and true spores."

I have thus, with slight alterations, followed the author at some length in the details of this singularly interesting series

**Promycelium*, the initiatory growth of the mycelium.

of facts, respecting what have been considered as three or more genera of the smaller and parasitical fungi. The account is in effect the epitome of DeBary's experiments, as given in the "Annales des Sciences Naturelles, Series 4, Vol. 20." Starting from *Uromyces*, we successively arrive at *Æcidium* or cluster-cups, and *Uredo* or Rust which, though found in some one of these stages on particular living plants, in reality belong to the development of one and the same parasite. Should any doubt arise as to the validity of these conclusions, the microscope and the too common occurrence of the several kinds or conditions afford facility for question and investigation. A study of similar stages of development by my friend Henry F. King, long ago interested me in the subject, and I here would bear grateful and willing testimony to his patience and skill in microscopical studies pertaining to the structure of the vegetable kingdom, and of its lower orders in particular.

Fig. 2.

The couch grass, or twitch grass (*Triticum repens*), is a well known weed, and though recommended for its nutritive qualities, is seldom cultivated unless in very light and dry soils. But with a pertinacity worthy a better fate, it springs up spontaneously in neglected spots, and can be found almost anywhere. Whoever is familiar with it, must have noticed that its broad leaves and stout stalks are frequently variegated and discolored by linear marks of a dusky hue, which on nearer inspection prove to be veritable cracks of the skin, from which protrude clusters of minute dusty particles. This diseased state is owing to a parasitic fungus, the *Puccinia graminis*, or the Rust, which sometimes does incalculable injury to grain crops. Many other plants are infested with the Puccinia Rust (Fig. 2; *a*, wheat-straw attacked by mildew, *Puccinia graminis*; *b*, cluster of spores of corn

mildew, magnified; *c*, single spore of corn mildew, *Puccinia graminis*, magnified 300 diameters. From Cooke), but as this is so common, let it serve as an example of the whole. If bent on investigating this rust, you will seek it in its first stage, in the form of yellowish elongated pustules, when it constitutes the *Trichobasis rubigovera* of the French botanist Léveillé, and distinguished by one-celled yellow spores, with thickened outer coverings, and supported on short peduncles, which shortly fall away. Later in the season, brown pustules may be observed on the leaves and stems of the same grass plant, and in these, when ripened, the spores are black, club-shaped, slightly constructed, and transversely divided by a septum, the peduncle or footstalk being distinct and permanent. Common as this pretty fungus is, it will repay attention in its microscopical study. In England by a strange confusion, such indeed as exists elsewhere among the unlearned, the first condition of this smaller fungus is termed the Rust, while the second is called *Mildew*. Allowing this latter name as applied to the Puccinia, "there is no doubt that the mildew is very injurious to the corn (grain) crop. Different opinions may exist as to how the plants become inoculated, or how the infection may be prevented or cured.—We are not aware that this question has been satisfactorily determined. It is worthy of remembrance by all persons interested in the growth of corn (grain), that the mildew is most common upon plants growing on the site of an old dunghill, or on very rich soil. As the same *Puccinia* is also to be found on numerous grasses, no prudent farmer will permit these to luxuriate around the borders of his fields, lest they should serve to introduce or increase the pest he so much dreads." (pp. 54, 55.)

I once had brought to me some stems of barley, so much infested with this little parasite, that the entire crop of straw anticipated was most materially injured. In some seasons scarcely any of the firmer and coarser leaved grasses escape its visits. Search for other species of this singularly

interesting small parasitic fungus would direct attention to the beauty and variety of the spores; and the leaves of some plants favorable to the growth of certain kinds become so seriously diseased that they appear scorched and burned; to such the old Anglo Saxon word, meaning *to burn*, long ago applied, still adheres in the corn "brands," mint brand, dandelion brand, etc., indicating a still minuter shade of difference where some are "elongated and tapering at each end, some crowned with spicular processes at the top, some echinulate* over the entire surface, and globose, elliptic, nearly parted in two, or others so variable in the same species "that no two are alike,"—any compound microscope of ordinarily good power, with a quarter inch objective, revealing these wonders and delighting the eye. Other beautiful species belonging to other genera of these smaller fungi await indeed the mycological student, and who could not be induced to botanize in such a field of wonders where "complex brands" likewise invite his finding; as in *Triphragmium* with its dark brown, echinulate, three-celled spores; in *Aregma* on the rose leaves with many-celled and cylindrical spores, also echinulate; in *Xenodochnus* with its many-parted, bead-shaped and distinctly articulated black spores; in *Ravenelia* with its acorn-shaped spores—some known to American botanists, others awaiting the fortunate discoverer. And precious as are the carefully dried and hoarded leaves which autumn has painted with matchless colors, how much more valued are they and others, if the receptacles of such microscopical treasures in the Rusts and Brands.

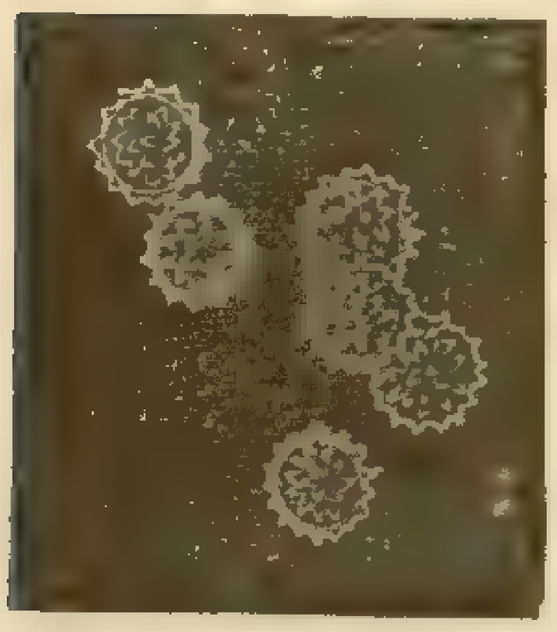
"One of the fungal diseases, long and widely known, has obtained among agriculturists different appellations in different localities. In some it is the *smut*, in others it is, respectively, *dust-brand*, *bunt-ear*, *black-ball*, and *chimney-sweeper*, all referring, more or less, to the blackish, sootlike dust with which the infected and abortive ears are covered. This fungus does not generally excite so much concern amongst

***Echinulate*, covered with small spines.

farmers as the other affections to which their corn crops are liable. Perhaps it is not really so extensively injurious, although it entirely destroys every ear of corn upon which it establishes itself."

In England and in Europe the "smut" here alluded to, is the *Ustilago segetum*, attacking the heads of wheat and other grain. It is also known in this country, but the one most familiar to us and readily observed on account of the size of the part of the plant it attacks, is the smut of Indian corn or maize, *U. Zeæ* (Fig. 3, spores of *Ustilago maydis*, the maize smut, magnified 400 diameters. From Cooke). The spores in this fungus are exceedingly numerous, "simple, deeply-seated, springing from delicate threads or in closely packed cells, ultimately breaking up into a powdery mass." Like the aforementioned parasites of Coniomycetes, the smut or *Ustilago* has numerous destructive forms which attack various portions of different living plants. Another European species also occurring in the United States according to Dr. Curtis, is the *U. hypodites*, of which we learn from a lecture delivered in the city of Norwich, England, in 1849, and to be found in the Report of the Commissioner of Patents, Executive Document, No. 15, Thirty-first Congress, 1849, that "its spores are black, round, and very small; that there was a great deal of it in 1848, in a field near King's Cliffe, almost every flower stem of the *Bromus sylvatica* being infected by it, and in addition to the ruin of the grass it was most pernicious. According to Léviellé the immense quantity of black dust resulting from it in the hay-fields in France, produces disastrous consequences on the haymakers, such as violent pains and swellings in the head and face, with great irritation over the entire system."

Fig. 3.

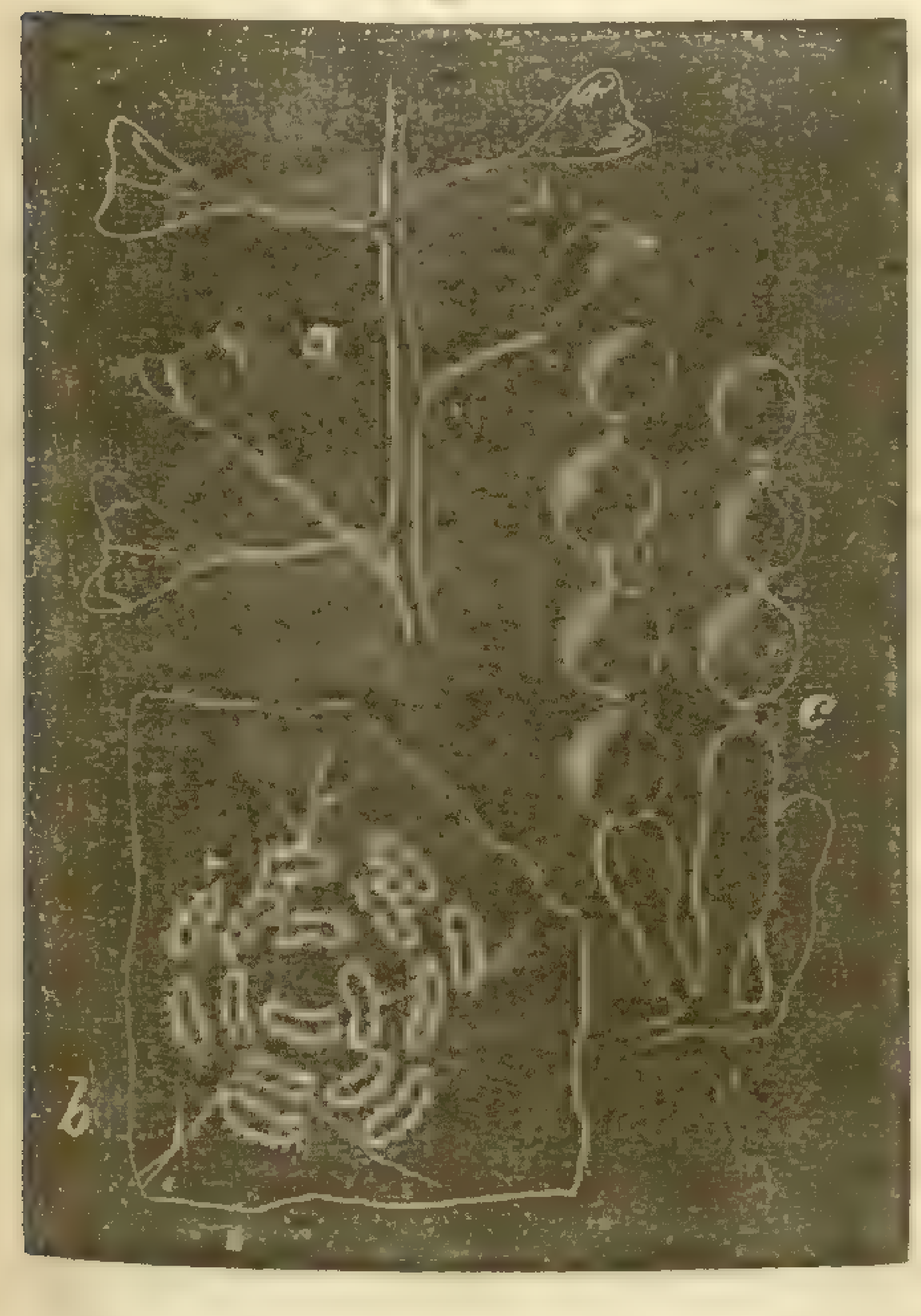


Like the "brands," the "smuts," too, have kinds with complex spores, of which one called *Polycystis*, or many-cysted smut, attacks the stems of violets, the leaves of but-

tercups, and similar plants. Although noticed abroad, as we learn from our author, the name does not occur in Dr. Curtis' list, nor the *Tubercinia*, whose bullate and blistered peridia attacks the European Trientalis, or star-flower, and may therefore reasonably be sought for by us in our northern New England co-species. The only approach to these complex smuts is in the *Thecaphora*, which differs from the maize smut, in its spores being made up of three or many irregularly hexagonal parts, each echinate and beautiful microscopic objects, which I think I once received from my friend Charles J. Sprague, Esq., who is so celebrated for his mycological knowledge of the fungi of Massachusetts.

The usual idea we have of rust and rustiness is something similar to the rust of iron, and a rusty color is one of a yellowish brown hue. But the word is used in a wider sense when employed to denote a parasitic fungal, and we accordingly are informed of "White Rust" in another of the smaller fungi, which, from its too intimate connection with agricultural crops, is worth some attention. Thus the white rust of the cabbage, turnip, and similar plants, is owing to the presence of the *Cystopus candidus* (Fig. 4; *a*, fruit of shepherd's-purse with white rust, *C. candidus*; *b*, portion of cabbage leaf with the same species; *c*, conidia of the same species. From Cooke), which appears in circular patches of white spots, and causes the leaves to become deformed, swollen and blistered, even before we can trace the cause of the mischief on the outside. These blistered pustules have a minute system of branching threads, which traverse the pulpy parts of the leaves, and which threads,

Fig. 4.



insinuating themselves between the cells that constitute the pulp, derive their nutriment at the expense of the growing foliage. It is after the pustules assume the white color, and are visible on the skin or cuticle, that the reproductive parts termed *conidia*, can be detected. Indeed the whole interior of the white pustules is made up of bundles of club-shaped tubes, which have been extended from the system of threads, and which tubes give off bead-like strings of cells, each bead by turns parting from the chain or necklace, and escaping into the air through the distended and ruptured pustule. From the multitude of these beads or spores, forming a white powdery dust, the term "conidia" is applied, which means dust-like. Other plants beside are similarly affected, and the water-cress, pepper-grass, mustard, radish, shepherd's-purse, and even the purslane, fall victims to its ravages. That so hardy a weed as the shepherd's-purse (*Capsella bursa pastoris*) should become pallid and sick, indicates the nature of the drain which is made on its juices by this parasite, and it is not improbable that the "clubbing" of the cabbage, where the stalk becomes gouty and swollen, and refuses to make a healthy growth, may be owing to similar exciting causes in the presence of the mycelium of some fungus in its tissues. From the researches of M. Provost, in 1807, we learn that the germination of the conidia, or spores, is one of the most curious phenomena of plant life, and indicates in this low order of vegetation, a relation to higher structural forms, not only in plants but even in animals. Thus, if a few particles of the white dust is thoroughly immersed in a drop of water, and examined under the microscope, "they will rapidly absorb the water and swell; soon afterwards a large and obtuse papilla, resembling the neck of a bottle, is produced at one end of the extremities. At first vacuoles* are formed in the contents of each conidium (spore). As these disappear, the whole granular substance filling the conidium becomes separated

* *Vacuole*, a little vacuum, or seeming empty space.

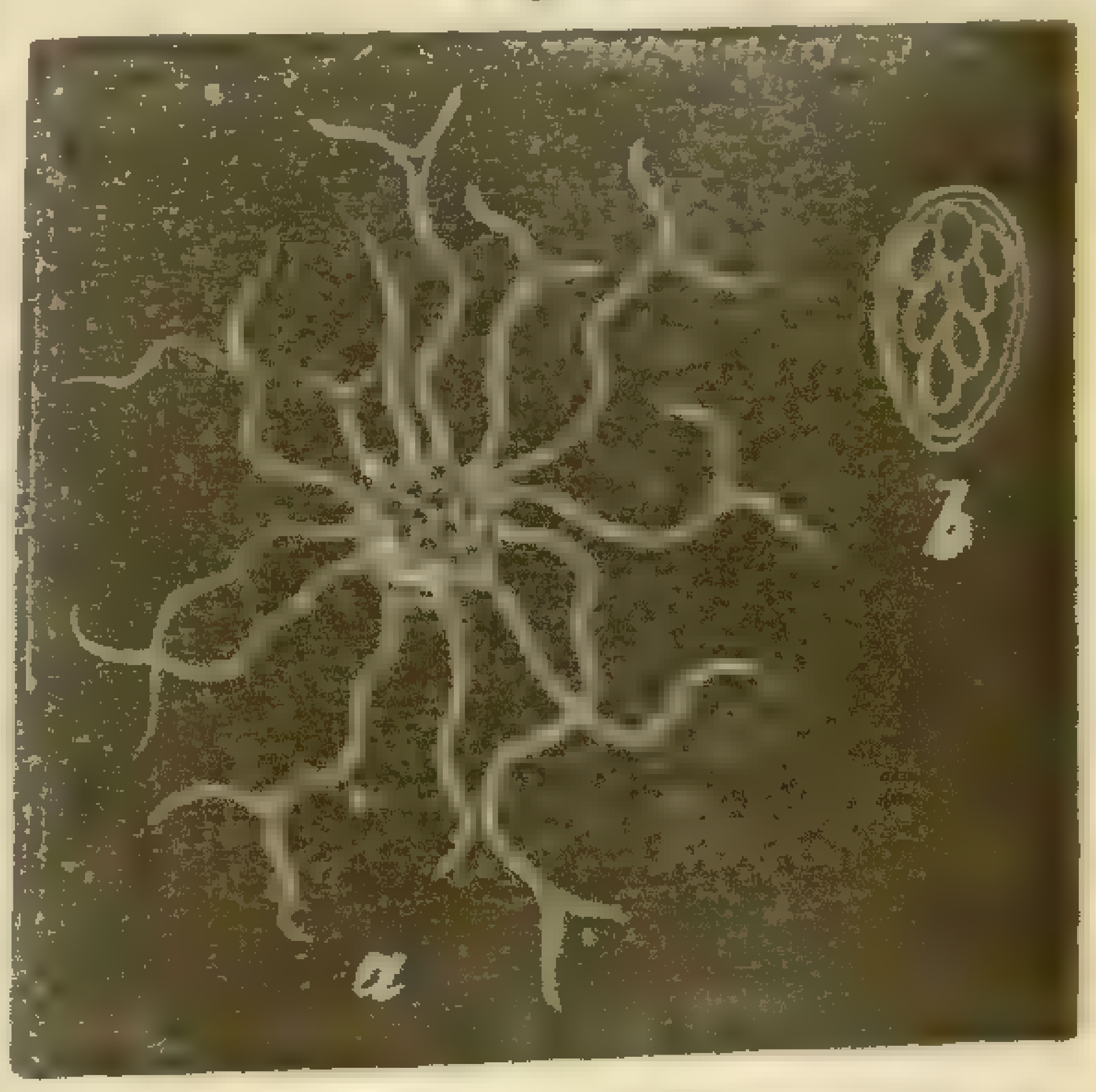
by very fine lines of demarcation, into five to eight polyhedric portions, each with a faintly colored vacuole in the centre. These portions are so many *zoöspores*. These are soon expelled one by one, afterwards begin to move, the zoöspores themselves provided with vibratile ciliæ swim away, each a seeming animalcule, but in reality only a sort of bud endowed with motion, and such as exist in some other plants. The particular office of the zoöspore, whether issuing from a conidium, or from some other process in the growth of the parasitical fungus, is to serve as a medium to the impregnation of the plant, be it weed or valuable farm vegetable; and curious to say it has been proved that the entrance into the pulp tissue of the same vegetable, is neither through the roots nor by absorption of the leaves, but invariably through the seed-leaves, first leaves or *cotyledons*, as they are scientifically termed. The prodigal provision of Nature is here, as everywhere, especially in its lower organizations signally manifested, when we are told that "the immense number of zoöspores capable of being produced from a single infested plant is almost beyond calculation. It is easy for a million of conidia to be developed from such a plant, each producing from five to eight zoöspores, besides a large number of other organs each containing a hundred zoöspores. It can scarcely be considered marvellous that the white rust should be so common on plants favorable to its development, the marvel being rather than that any plant should escape." (p. 136.)

Quite a distinct family of the smaller fungi, and far more injurious in many instances, is termed *Hyphomycetes*, *i. e.*, fungi whose growth consists in throwing out delicate threads. In this family there are several distinct but natural groups, and with one of these groups called the *Mucedines*, we have something to do. The little fungi here specified are the true *Moulds*, and very naughty effects they produce, as we shall learn on a better acquaintance than the usually superficial one, which is confined to mouldy bread and cheese and other

viands, and which are so bright and vivid in color that they at once attract the attention, the most alarming and insidious requiring the higher powers of the microscope, and under their almost invisibility working signal destruction. Like the coniomycetes, or dust-fungi, which we have noticed, the hyphomycetes or thread-fungi, and the mucedines or true moulds, which are included, are provided with a vegetative system of branching threads, called the mycelium, but unlike the former, these have fertile or spore-bearing threads which are perfectly distinct. These latter kinds are "sometimes simple and sometimes branched; they may be articulated or without articulations; short or long, erect or creeping; transparent or whitish, mostly free from color, and are not coated with a distinct membrane. The spores are generally simple, sometimes solitary, at others in pairs or strung together like beads for a necklace. Amongst all this variety of arrangement there is order, for these are but features, or partly the features of the different genera of which the *Mucedines* are composed. One of the genera is termed *Peronospora*, known by its having for the most part inarticulate or jointless threads and two kinds of spores, one kind on the tips of the branches, the other, larger and globose, on the creeping mycelium or spawn. The diseases of many of the most valuable farm crops, are in Europe and England attributed to the several species of the Peronospora, and are called the dock, lettuce, onion, parsnip, potato, rose, spinach, and tare or vetch moulds; each so specifically distinct as to be recognized on whatever plant may foster it, and destructive and dangerous. Whether the same kinds, or indeed whether the peronospora injuriously affects the same vegetables in this country, observation and research at present only can decide. Its effects in the potato disease are considered in a paper in a previous issue of the NATURALIST. I only know that I have met with a similar mould on decaying Agarics, strongly resembling Caspary's figures, and to which allusion has before been made. In like manner the "white mildews

or blights" are due to sundry other hyphomycetes or thread-like smaller fungi, which, equally abroad and in this country seriously affect the leaves and fruits, and seed-vessels of various living plants. Of these mention has been made of the *Erysiphe* when noticing the dimorphism of certain fungi, and the list of plants to which the several species of this injurious little fungal growth and of its allies attaches itself, would be perhaps about the same at home or abroad. Any one who has had to do with the greenhouse kept at a low temperature, with the plant propagating house, or with the culture of the parlor plants, must be familiar with the rose-leaf mildew, especially when it so suddenly attacks the finer and tender sorts of the tea roses; and will recognize in the following description this insidious pest: "The first species in our enumeration is found on cultivated roses. What a deplorable picture does a favorite rose-bush present when attacked by this mildew! The leaves blistered, puckered and contorted; their petioles and the peduncles and calyces of the flowers swollen, distorted, and gray with mould, and the whole plant looking so diseased and leprous that it needs no mycologist to tell that the rose is mildewed. This species is the *Sphærotheca pannosa* of Léveillé." (pp. 165, 166.) The hop mildew abroad is an allied species, the hazel, oak and beech mildew attacks the alder leaves here in *Phyllactinia guttata;* the English willow blight is here found "common on living leaves" (Curtis); the foreign barberry mildew, *Microsphæria*, is here under several species; the common white mildew, *Erisyphe communis* (Fig. 5; *a*, conceptacle of buttercup blight × 80, *E. communis; b*, sporangium of the same, highly magnified. From Cooke), is so "common" that it well deserves the name; the singular bristle mould, *Chætomium chartarum*, attacks wet paper here as well as

Fig. 5.



abroad. Another bristle mould is found on rotting grass; the *Eurotium herbariorum*, pesters our botanists by its presence in their collections of dried plants, and so wide is the geographical range of many kinds of smaller fungi, that no country and scarcely any latitude escapes their visitations.

The exquisite elegance of the spores of the fungi should suggest the dry and wet mounting of them in glass slides for the microscope. Entire plants and portions of others could be readily prepared, and the patience, enthusiasm, and skill of a Bicknell are all that are requisite for a beginning in this direction.

It is with extreme reluctance that we lay down this fascinating little treatise; its pages indeed may be read and re-read with constant profit. To this and to similar works, the botanist, the general enquirer, and the agriculturist are equally indebted, and well will it be for this country when the American press shall issue many and such as this.

A CHAPTER ON FLIES.

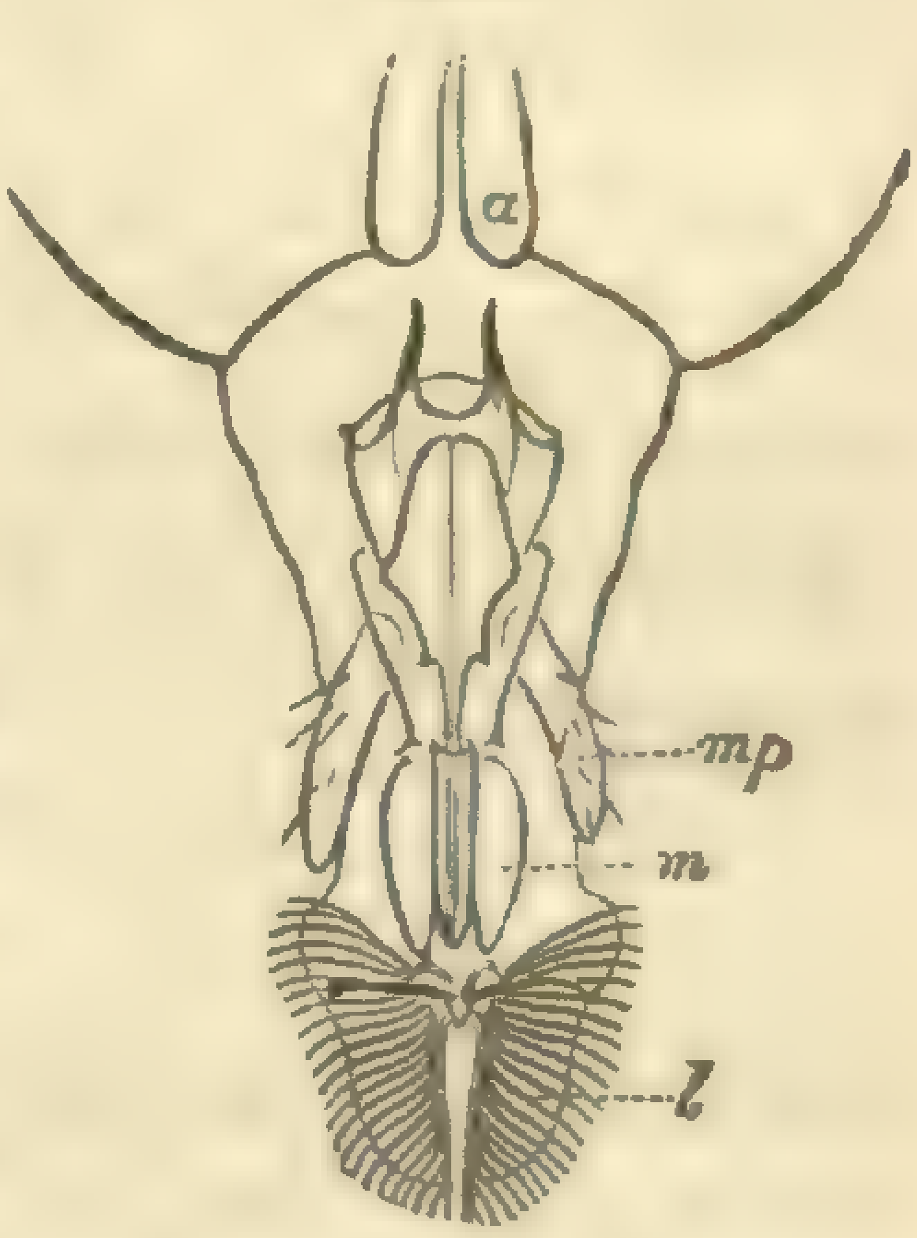
BY A. S. PACKARD, JR.

[Concluded from page 596.]

THE common House-fly, *Musca domestica* Linn., scarcely needs an introduction to any one of our readers, and its countenance is so well known to all that we need not present a portrait here. But a study of the proboscis of the fly reveals a wonderful adaptability of the mouth-parts of this insect to their uses. We have already noticed the most perfect condition of these parts as seen in the horse-fly. In the proboscis of the house-fly the hard parts are obsolete, and instead we have a fleshy tongue-like organ (Fig. 1), bent up underneath the head when at rest. The maxillæ are minute, and their palpi (*mp*) are single-jointed, and the mandibles

(*m*) are comparatively useless, being very short and small, compared with the lancet-like jaws of the mosquito or horse-fly. But the structure of the tongue itself (labium, *l*) is most curious. When the fly settles upon a lump of sugar or other sweet object, it unbends its tongue, extends it, and the broad knob-like end divides into two broad, flat, muscular leaves (*l*), which thus present a sucker-like surface, with which the fly laps up liquid sweets. These two leaves are supported upon a framework of tracheal tubes, which act as a set of springs to open and shut the muscular leaves. This framework of tracheæ does not seem to have been noticed in the books at hand while writing, Mr. Edward Bicknell having first called my attention to it. He has mounted specimens, previously treated with potash, for the microscope, in his unequalled style, which illustrate admirably the structure of the end of the proboscis. In the cut given above, Mr. Emerton has faithfully represented these modified tracheæ, which end in hairs projecting externally. Thus the inside of this broad fleshy expansion is rough like a rasp, and as Newport states, "is easily employed by the insect in scraping or tearing delicate surfaces. It is by means of this curious structure that the busy house-fly occasions much mischief to the covers of our books, by scraping off the albuminous polish, and leaving tracings of its depredations in the soiled and spotted appearance which it occasions on them. It is by means of these also that it teases us in the heat of summer, when it alights on the hand or face to sip the perspiration as it exudes from, and is condensed upon, the skin."

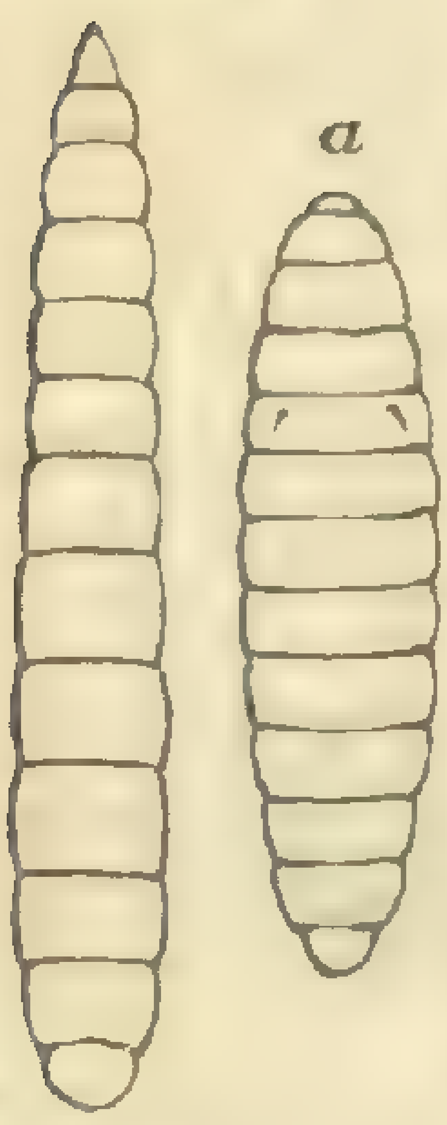
Fig. 1.



Every one notices that house-flies are most abundant around barns in August and September, and it is in the ordure of stables that the early stages of this insect are

passed. No one has traced the transformations of this fly in this country, but we copy from Bouché's work on the transformations of insects, the rather rude figures of the larva (Fig. 2), and puparium (*a*) of the *Musca domestica* of Europe, which is supposed to be our species. Bouché states that the larva is cylindrical, rounded posteriorly, smooth and shining, fleshy, and yellowish white, and is four lines long. The puparium is dark reddish brown, and three lines in length. It remains in the pupa state from eight to fourteen days. In Europe it is preyed upon by minute ichneumon flies (*Chalcids*). The flesh-fly, *Musca Cæsar*, or the Bluebottle-fly, feeds upon decaying animal matter. Its larva (Pl. 13, fig. 6) is long cylindrical, the head being pointed, and the body conical, the posterior end being squarely docked. The larva of an allied form which feeds on offal, etc., transforms into a flattened puparium (Pl. 13, fig. 5), provided with long scattered hairs. The House-fly disappears in autumn, at the approach of cold weather, though a few individuals pass through the winter, hibernating in houses, and when the rooms are heated may often be seen flying on the windows. Other species fly early in March, on warm days, having hibernated under leaves, and the bark of trees, moss, etc. An allied species, the *M. vomitoria*, is the Meat-fly. Closely allied are the parasitic species of Tachina, which live within the bodies of caterpillars and other insects, and are among the most beneficial of insects, as they prey on thousands of injurious caterpillars. Another fly of this Muscid group, the *Idia Bigoti*, according to Coquerel and Mondiere, produces in the natives of Senegal, hard, red, fluctuating tumors, in which the larva resides.

Fig. 2.



Many of the smaller Muscids mine leaves, running galleries within the leaf, or burrow in seeds or under the bark of plants. We have often noticed blister-like swellings on the bark of the willow, which are occasioned by a cylindrical

short fleshy larva (Pl. 13, fig. 3 *a*, much enlarged), about .12 of an inch in length, which changes to a pupa within the old larval skin, assuming the form here represented (Pl. 13, fig. 3 *b*), and about the last of June changes to a small black fly (Pl. 13, fig. 3), which Baron Osten Sacken refers doubtfully to the genus *Lonchæa*.

The Apple-midge frequently does great mischief to apples after they are gathered. Mr. F. G. Sanborn states that nine tenths of the apple crop in Wrentham, Mass., was destroyed by a fly supposed to be the *Molobrus mali*, or Apple-midge, described by Dr. Fitch. "The eggs were supposed to have been laid in fresh apples, in the holes made by the Coddling-moth (*Carpocapsa pomonella*), whence the larvæ penetrated into all parts of the apple, working small cylindrical burrows about one-sixteenth of an inch in diameter." Mr. W. C. Fish has also sent me, from Sandwich, Mass., specimens of another kind of apple worm, which he writes me has been very common this year in Barnstable county. "It attacks mostly the earlier varieties, seeming to have a particular fondness for the old fashioned Summer, or High-top Sweet. The larvæ (Pl. 13, fig. 2 *a*) enter the apple usually where it has been bored by the Apple-worm (*Carpocapsa*), not uncommonly through the crescent-like puncture of the curculio, and sometimes through the calyx, when it has not been troubled by other insects. Many of them arrive at maturity in August, and the fly soon appears, and successive generations of the maggots follow until cold weather. I have frequently found the pupæ in the bottom of barrels in a cellar in the winter, and the flies appear in the spring. In the early apples, the larvæ work about in every direction. If there are several in an apple, they make it unfit for use. Apples that appear perfectly sound when taken from the tree, will sometimes, if kept, be all alive with them in a few weeks." Baron Osten Sacken informs me that it is a *Drosophila*, "the species of which live in putrescent vegetable matter, especially fruits."

An allied fly is the parent of the cheese maggot. The fly itself, *Piophila casei* (Pl. 13, fig. 1), is black, with metallic green reflections, and the legs are dark and paler at the knee-joints, the middle and hind pair of tarsi being dark honey yellow. The Wine-fly is also a Piophila, and lives the life of a perpetual toper in old wine casks, and partially emptied beer, cider, and wine bottles, where, with its puparium (Pl. 13, fig. 4), it may be found floating dead in its favorite beverage.

We now come to the more degraded forms of Diptera which live parasitically on various animals. We figure, from a specimen in the Museum of the Peabody Academy, the Bird-tick, *Ornithomyia* (Pl. 13, fig. 7), which lives upon the Great Horned Owl. Its body is much flattened, adapted for its life under the feathers, where it gorges itself with the blood of its host.

In the wingless Sheep-tick, *Melophagus ovinus* (Pl. 13, fig. 10, with the puparium on the left), the body is wingless and very hairy, and the proboscis is very long. The young are developed within the body of the parent, until they attain the pupa state, when she deposits the puparium, which is nearly half as large as her abdomen. Other genera are parasitic on bats, among them are the singular spider-like Bat-tick, *Nycteribia* (Pl. 13, fig. 11), which have small bodies and enormous legs, and are either blind, or provided with four simple eyes. They are of small size, being only a line or two in length. Such degraded forms of Diptera are the connecting links between the true six-footed insects and the order of Arachnids (spiders, mites, ticks, etc.). The reader should compare the Nycteribia with the young six-footed moose-tick figured on page 559 of the NATURALIST. Another spider-like fly is the *Chionea valga* (Pl. 13, fig. 12), which is a degraded Tipula, the latter genus standing near the head of the sub-order Diptera. The Chionea, according to Harris, lives in its early stages in the ground like many other gnats, and is found early in the spring, sometimes crawling over the snow.

We have also figured and mentioned previously (page 197) the Bee-louse, *Braula*, another wingless spider-like fly.

The Flea is also a wingless fly, and is probably, as has been suggested by an eminent entomologist, as Baron Osten Sacken informs us, a degraded genus of the family to which Mycetobia belongs. Its transformations are very unlike those of the fly-ticks, and agree closely with the early stages of Mycetophila, one of the Tipulid family. In its adult condition the flea combines the characters of the Diptera, with certain features of the grasshoppers and cockroaches (Orthoptera), and the bugs (Hemiptera). The body of the human flea (Pl. 13, fig. 13, greatly magnified; *a*, antennæ; *b*, maxillæ, and their palpi, *c*; *d*, mandibles; the latter, with the labium, which is not shown in the figure, forming the acute beak) is much compressed, and there are minute wing-pads, instead of wings, present in some species.

Dr. G. A. Perkins, of Salem, has succeeded in rearing in considerable numbers from the eggs, the larvæ of a flea which lives upon the cat. The larvæ (Pl. 13, fig. 9, much enlarged; *a*, antenna; *b*, the terminal segments of the abdomen), when hatched, are .05 of an inch long. The body is long, cylindrical, and pure white, with thirteen segments exclusive of the head, and provided with rather long hairs. It is very active in its movements, and lives on decaying animal and vegetable matter, remaining on unswept floors of out-houses, or in the straw or bed of the animals they infest. In a few days after leaving the egg the larvæ mature, spin a rude cocoon, and change to pupæ, and the perfect insects appear in about ten days.

A practical point is how to rid dogs of fleas. As a preventive measure, we would suggest the frequent sweeping and cleansing of the floors of their kennels, and renewing the straw or chips composing their beds,—chips being the best material for them to sleep upon. Flea-afflicted dogs should be washed every few days in strong soapsuds, or weak tobacco or petroleum water. A writer in "Science-Gossip"

recommends the "use of the Persian Insect Destroyer, one package of which suffices for a good sized dog. The powder should be well rubbed in all over the skin, or the dog, if small, can be put into a bag previously dusted with the powder; in either case the dog should be washed soon after."

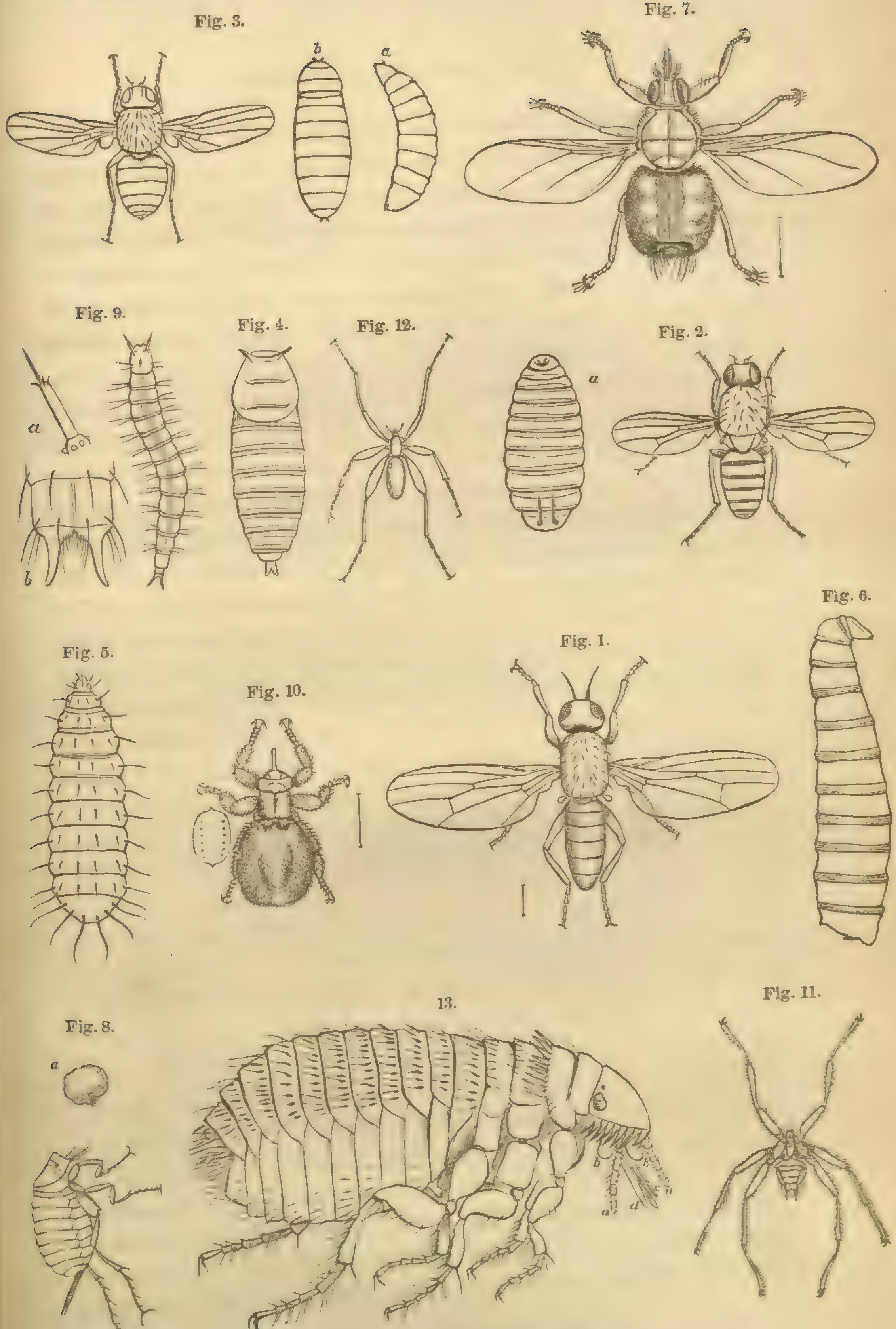
One of the most serious insect torments of the tropics of America is the *Sarcopsylla penetrans*, called by the natives the Jigger, Chigoe, Bicho, Chique, or Pique (Pl. 13, fig. 8, enlarged; *a*, gravid female, natural size). The female, during the dry season, bores into the feet of the natives, the operation requiring but a quarter of an hour, usually penetrating under the nails, and lives there until her body becomes distended with eggs, the hind-body swelling out to the size of a pea; her presence often causes distressing sores. The Chigoe lays about sixty eggs, depositing them in a sort of sac on each side of the external opening of the oviduct. The young develop and feed upon the swollen body of the parent flea until they mature, when they leave the body of their host and escape to the ground. The best preventative is cleanliness and the constant wearing of shoes or slippers when in the house, and of boots when out of doors.

NOTE.—All the figures on Plate 13, except 8 *a*, are enlarged.

A TRIP TO THE GREAT RED PIPESTONE QUARRY.

BY C. A. WHITE, M. D.

THE Great Red Pipestone Quarry, from whence the Indians occupying a large portion of the North American continent have from time immemorial obtained the material for their pipes, has become almost as famous among those who speak the English language as among the aborigines themselves, who, to some extent at least, regard it as a sacred place. This is largely due to the interest which has been



PACKARD ON FLIES.

excited by the observations of Catlin and Schoolcraft upon the habits, customs and legends of the Indians, but more especially to the unique poetic form in which our much-loved Longfellow has rendered some of them in his "Song of Hiawatha." Before the reader goes farther let him take down this strange song and read the "Peace-pipe," after which he will better understand the references which follow. In addition to this I will give the substance of the legends which occur in various forms among the Indians of the North-west concerning this famous locality.

"Many ages ago the Great Spirit, whose tracks in the form of those of a large bird are yet to be seen upon the rocks descending from the heavens, stood upon the cliff at the Red Pipestone. A stream issued from beneath his feet, which, falling down the cliff, passed away in the plain below, while near him, on an elevation, was the Thunder's nest in which a small bird still sits upon her eggs, the hatching of every one of which causes a clap of thunder. He broke a piece from the ledge, and formed it into a huge pipe and smoked it, the smoke rising in a vast cloud so high that it could be seen throughout the earth, and became the signal to all the tribes of men to assemble at the spot from whence it issued, and listen to the words of the Great Spirit. They came in vast numbers and filled the plain below him. He blew the smoke over them all, and told them that the stone was human flesh, the flesh of their ancestors, who were created upon this spot; that the pipe he had made from it was the symbol of peace; that although they should be at war, they must ever after meet upon this ground in peace and as friends, for it belonged to them all; they must make their calumets from the soft stone, and smoke them in their councils, and whenever they wished to appease him or obtain his favor. Having said this, he disappeared in the cloud which the last whiff of his pipe had caused, when a great fire rushed over the surface and melted the rocks, and at the same time two squaws passed through the fire to their places beneath

the two medicine rocks, where they remain to this day as guardian spirits of the place, and must be propitiated by any one wishing to obtain the Pipestone before it can be taken away." . . . .

While tracing up to their original ledges in North-western Iowa and the adjacent parts of Dakota and Minnesota, the boulders of red quartzite profusely scattered in the drift of Western Iowa and Eastern Nebraska, I was led to visit this famous locality, and now propose to give a brief description of its real character and surroundings. But while correcting the fallacies of the Indian legends, no wish is entertained of diminishing popular interest in them, nor in the beautiful rendering of them by the poet; yet every naturalist, however attractive legendary lore or poetic forms of expression may be to him, really desires to know the exact truth, even if it diminishes the pleasure he feels in the enchanting narrations of story or song.

Leaving Sioux City and going northward along the east side of the Big Sioux River, we soon pass the northern limit of the bluff formation, with the strange beauty of its smoothly rounded hills, described in a former number of the NATURALIST, and enter upon the broad prairie which continues without interruption far to the eastward, still farther to the northward into Minnesota, and farther still to the westward towards the Rocky Mountains. Rocks of Cretaceous age are occasionally exposed in the bluffs of the river for a dozen miles above its mouth, but being friable, they are soon lost from sight beneath their own debris and the heavy drift-mantle that everywhere covers the earth: and the only rocks we see in many miles of travel are occasional boulders of granite and red quartzite embedded in the deep, rich soil. Streams of considerable size traverse some portions of this wide region, but they are hardly able to arrest the fierce fires of the prairie which annually prevail, for they rush up to their very margins, and sometimes even leap the watery space and carry on their work of destruction

beyond. A few clumps of willows upon their margins, and a few groves upon the islands or in the bends of the streams, only escape destruction, and are the only objects remaining to give diversity to the landscape, except the bald bluffs bordering the larger streams.

A journey of eighty miles over such a country as this brings us to the north-western corner of the State of Iowa, where we first find ledges of the red quartzite in place, which we have traced as scattered boulders, step by step from the Missouri state line, more than two hundred miles away to the southward.

Following up the Big Sioux from this point, we find the quartzite exposed at frequent intervals along the valley, and reaching Sioux Falls, twenty miles by way of the crooked river, but only ten miles in a direct line north-westward from the State corner, we find a magnificent exposure of the same rock extending across the river, and causing a series of falls of sixty feet in aggregate height, within the distance of half a mile, which for romantic beauty are seldom surpassed.

This quartzite is of a nearly uniform brick-red color, intensely hard, quite regularly bedded, the bedding surfaces sometimes showing ripple markings as distinct as any to be seen upon the sea-shore of the present day, and which were made in the same manner untold ages ago, when this hard rock was a mass of incoherent sand, the grains of which are even now distinctly visible. In a few localities it presents the characters of conglomerate, the pebbles being as clearly silicious as the grains of sand. At Sioux Falls, Fort Dakota is located. Those who have never enjoyed the hospitality of our distant military posts, cannot appreciate the full meaning of that word as we did, in the welcome extended to our tired party, by Col. Wm. A. Olmstead, the Commandant, and Dr. J. Frazer Boughter, the Surgeon.

After divers and sundry ablutions, rendered all the more necessary by many days of toil and travel upon the open prairie beneath a July sun, we prepare ourselves for a day's

rest under the protection of our newly found friends and our country's flag. At Sioux Falls, near the top of the exposure, a layer of Pipestone occurs intercalated with the quartzite, which leads us to believe that the rock at the famous Quarry is the same, and we decide to visit it. After discussing the probabilities of there being roving parties of hostile Sioux in the vicinity, and the necessity for the presence of the good doctor in his hospital for a couple of days, it is finally agreed that he shall accompany us under the escort of an Indian guide given us by the Commandant. Our guide, we are assured, is "a pretty good Indian," notwithstanding the fact that he was one of Little Crow's band who were engaged in the massacres of New Ulm and Jackson, Minnesota—the recital of which, by the survivors, has made our hearts sick as we have listened to them, upon the scenes of the butcheries where the marks of their violence still remain—for is it not six years since all that happened? and did not the missionaries labor faithfully with him during the two years of his imprisonment at Davenport for his crimes?

The morning rose clear and beautiful after a refreshing rain of the previous night, and off we go, "six precious souls," including the reformed baby-killer, who rides before us on his pony with that posture and carriage peculiar to the Indian, his legs dangling upon each side as if every bone in them had been broken and had united by cartilaginous union, while we, the other five, seated in our camp wagon, follow upon the dim road or the *tepe trail* over the broad prairie, striving to keep in sight of our guide, who is sometimes several miles ahead of us. Our course is about north north-east from the fort, and when we lose sight of the narrow, interrupted belt of trees which skirts the Big Sioux, not another tree greets our vision in the whole journey of forty miles, save a single elm by the side of a small creek, where we halt to take our mid-day meal. Here our guide tells us we must gather a bundle of faggots from the willows of the brook, which last year's fires had killed but not con-

sumed, or we shall have no camp-fire at the Pipestone, where we must pass the night.

On we go, after a hasty meal, for twenty miles of our journey is yet to be made, and we lose sight of the only tree we shall see until we return to the fort. There is nothing around us or beneath us but the gently undulating prairie with its dense growth of grass and flowers, and nothing above us but the open sky. Twice or thrice we detect small exposures of the red quartzite in the depressions occupied by the small prairie streams, with their surfaces scored by the boulder-laden glaciers which moved over them long ago. Now and then a solitary boulder, fellows of those that scored the surfaces of the rocks in place, peers up out of the rich loamy soil. Now and then the whitening skull of a buffalo, or the huge cast-off antlers of an elk, partially hidden by the rank grass, arrests our attention, but these are familiar things, and we pass the time in conversation upon various topics until late in the afternoon, when our guide halts upon an eminence before us. Upon coming up, he merely says "Pipestone" as he points forward, and there, three miles away in the distance, is the famous spot.

We had not expected to see conspicuous features of the landscape anywhere in such a region as this, and yet we were somewhat disappointed to find that the narrow ledge of rocks in the broad shallow valley of a little prairie creek, lying entirely below the general prairie level, constitutes all there is of the Great Pipestone Quarry. As far as the eye can reach in every direction, no "mountain of the prairie," no grove, no tree, no habitation, no living thing except a few birds, is in sight. From our maps and Government surveys, we know the spot is within the State of Minnesota, about thirty miles in a direct line from its south-western corner, and three or four miles from its western boundary. Approaching it, the exposure of rocks appears much greater than it did in the distance, when it looked like a mere line

of broken rocks in the open prairie, for our view then took in the whole region for many miles around it.

The annexed diagram, although drawn merely from memory and without linear measurements, will serve in some degree to give an idea of the relative positions of the principal features of the locality. D E is intended to represent the principal exposure of rocks, which is about a mile in length from north to south, in both of which directions it

Great Pipestone Quarry.

becomes gradually lost from view beneath the surface of the prairie. It faces the west, and reaches its greatest perpendicular height, about twenty feet, at A, where "Gitche Manito, the mighty," is supposed to have stood when he took his wonderful smoke, and where the brook falls over it into the plain below. All the rock we see is the red quartzite and a few granite boulders whose original home is still farther north, and we look some time in vain for the Pipestone, for our guide volunteers no information, and we have forgotten in our eagerness to ask him. But our cook calls to supper, and all of us satisfy our hunger, a different thing by the way for *Mazachistina*, alias John Baker, whose appetite seems as insatiate as that of a grist-mill. Having finished this delightful task, he becomes more communicative and

goes to show us the Pipestone, which deposit of aboriginal treasure we find in the plain an eighth of a mile west of the principal exposure of the rock, occupying a shallow ditch (B) a quarter of a mile long, and running parallel with it. The Pipestone is in somewhat thin and usually shaly layers, and only from eight to twelve inches in aggregate thickness, and is the lowest layer found here. The red quartzite rests immediately upon it, and is four or five feet thick at the ditch, and must be removed to get the Pipestone. This has been accomplished with great labor by the Indians, for they do not even now use suitable implements to remove it. The ditch occupies about the middle of the space referred to as the plain, and from it the ground rises gently both eastward and westward. To the westward the rise to the general prairie level is uninterrupted, and no more rock is seen in that direction. To the eastward the gentle rise is interrupted by the abrupt face of the quartzite ledges, between which and the ditch frequent exposures of the same rock are seen upon the nearly level surface. The actual height from the Pipestone in the bottom of the ditch, which is about the lowest point in the vicinity, to the top of the ledges at A, which point is just below the general level of the prairie, is only forty feet, but the dip of all the rocks to the eastward is such as to show an actual thickness of strata amounting to one hundred and fifty feet. This dip causes the top ledges to disappear rapidly to the eastward beneath the marshy surface, and they are seen no more in that direction. The "Medicine Rocks," (C) towards the southern end of the plain, rest directly upon the glacier-smoothed surface of the quartzite. We see the distinct striæ beneath and around them, and feel almost as if we had caught them in the very act of making their tracks, for they are granite strangers from the northward, and we have visited the place where they were born, and know them and their generation. The two largest of these boulders are some twelve or fifteen feet in diameter, and are the ones believed by the Indians to

cover the two squaws mentioned in the legend. Along the low and less abrupt portions of the ridge of rock, the surface has a glazed and sometimes even a polished appearance, which the legend refers to the effects of the fire through which the squaws passed beneath the Medicine Rocks, but being a geologist and not an Indian, I would suggest that it was produced by grains of sand carried by the almost constant winds, and taken up from the soil, which, although fertile, contains a perceptible quantity.

Many square yards of the glacier-smoothed surface at the Medicine Rocks are covered thickly with Indian hieroglyphics, made by pecking the hard surface with sharp-pointed stones. These are of various grotesque forms, intended to represent persons, animals of the region, turtles, and very many also *in the form of the tracks of a large bird.* It is getting dark, and we defer collecting specimens of Pipestone until morning, and repair to camp and to bed. But memories and passing incidents crowd so thickly upon us that we cannot sleep. A summer storm is sweeping along to the northward of us. We see its dim flashes and hear its mutterings in the direction of the "Thunder's nest." *That* thunder was surely not hatched there, but before darkness overtook us at the "nest"—which by the way is a scarcely perceptible rise of surface—we had found upon the bare rock two or three pairs of the eggs of that "small bird" mentioned in the legend. It is the Night-hawk (*Chordeiles Henryi?*). We smiled at the strange conceit that the hatching of the eggs causes thunder, but we were, nevertheless, startled at the unearthly rumbling cry of the parent bird, as it swooped down over our heads while we were carrying its treasures away.

The morning comes and we ramble along the creek to replenish our wasting bundle of faggots. A few stunted Common Willows (*Salix longifolia?*) grow along the banks, but no "Red Willow" (*Cornus stolenifera*), the bark of which, under the name of Kinnikinnick, is smoked by the Indians

in the place of tobacco, grows here. The Reed-grass (*Phragmites communis*) grows in all wet places here, as well as throughout the north-west, but it is seldom if ever used by the Indians for their pipestems. They commonly use a strong piece of young ash wood, from which they punch the pith to make the bore.

The form and size of the pipes made by the Indians requires so large a piece of stone, that we have no difficulty in obtaining all the specimens we desire from the rejected pieces strewn upon the ground. Our specimens packed in the wagon, and our camp broken up, we start on our return to the fort by the *tepe trail* shown in the diagram. Maza-chistina mounts at the same time, but starts off towards the Medicine Rocks, around which he makes a rapid turn and overtakes us upon the road. He is utterly silent when we ask him why he went there, but we should doubtless be thankful that we got away with our Pipestone in safety from the wrath of the guardian spirits of the Medicine rocks.

But some one asks, "What is this Pipestone, and what is its composition?" It is chemically a clay (silicate of alumina) colored brick-red with per-oxide of iron. It is too heavy for pipes for white men, and is valued by them almost entirely for its legendary interest. It is heavier, harder, and in every respect inferior to meerschaum,—silicate of magnesia,—yet the purer specimens may be worked without much difficulty with a common saw, file, or knife, and readily takes and retains a considerable polish. Geologically it is metamorphic clay, as the quartzite is metamorphic sandstone. It was originally a layer of clay intercalated between layers of sandstone, and the same metamorphic action that changed the latter to a quartzite, also converted the clay into Pipestone.

REVIEWS.

Comparative Anatomy and Medical Zoölogy.* — As its title purports, so do we find its contents. The "Outlines" are carefully drawn and well filled out, and the student of comparative anatomy will find it a hand-book that will be convenient at all times. It is gratifying to find so rational a view of classification as the author here presents. He seems to appreciate fully the various subdivisions among animals, though we disagree with him in his adopting Leuckart's class *Cœlenterata*. It seems to us that Agassiz has never made a clearer point than in his demonstrations of the class value of Polyps and Acalephs, and he (Agassiz) excuses the readiness with which German naturalists acquiesce in Leuckart's bringing together these two classes under the above title, from the fact that their opportunities for studying the various members of the two classes are limited. Perhaps the same apology might be made for Dr. Allen! Under such headings as Skeleton, Articulation, Teeth, Digestive System, etc., he passes in each case from the lowest to the highest animals, mentioning briefly the characters under discussion possessed by both. Thus, for example, under Kidneys, we have: "*Myriapoda*, — Kidney composed of long convoluted tubes," etc. "*Arachnida*, several cœca empty into intestinal canal," etc.

In a work of this character requiring the collation of so many facts, it would not be surprising to find a few mistakes or oversights, and we point out for correction those that have already attracted our attention. He says that in Polyzoa no nervous system has with certainty been detected. A nervous ganglion has been recognized by Fritz Müller among the marine forms, and by Allman, Dr. Nitche, Mr. Hyatt, and others, among the fresh-water species. Two branches from this ganglion have been figured. It is stated that no organ among the Invertebrata has been definitely assigned to the functions of smelling. Moquin Tandon has quite conclusively shown, we think, that in the minute nerve termini, at the extremity of the upper tentacles of land inoperculate pulmonates is seated the sense of smell. It is stated also (evidently a slip of the pen) that fresh-water snails carry their eyes at the tip of the tentacles, whereas it is just the reverse, and that marine species carry their eyes at the outer base of the tentacles; this is true with several important exceptions. The statement is made that the eyes of *Natica* and *Bulla* are conspicuous, while they are quite inconspicuous or wanting. It is stated that among the lowest animals the eye and ear resemble each other so closely that it is difficult to distinguish them apart, but that the presence of the vibrating otolites will afford a distinction. Would not another reason be found in the external position of one, and the internal position of the other?

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*Outlines of Comparative Anatomy and Medical Zoölogy. By Harrison Allen, M. D. J. B. Lippincott & Co. 1868. pp. 190, 8vo.

At the end of the book there is a table of classification, including three hundred and eight genera mentioned in the pages. This number does not include several names inadvertently tabulated with them, which apply only to the larval condition of animals. We say inadvertently, since the matter is correctly given in the preceding pages. We again cordially commend this book as one possessing a vast amount of matter, concisely stated, and clearly arranged, and when one considers the unusually large space allotted to the invertebrate animals, remarkably free from errors.

ENTOMOLOGIST'S ANNUAL FOR 1868.—It is proposed, should sufficient encouragement be given, to publish a Year Book of Progress in American Entomology, to be edited by Dr. A. S. Packard, jr. Dr. J. L. Le Conte will contribute a chapter on the Coleoptera; Mr. S. H. Scudder chapters on the Butterflies and Orthoptera; Baron R. Osten Sacken a chapter on the Diptera; Mr. P. R. Uhler a chapter on the Hemiptera and Neuroptera; and the Editor expects to receive aid from other entomologists. It is hoped it will prove a useful hand-book to every one interested in the study of insects. It will be published in 12mo size in the spring of 1869. An edition of five hundred will be printed, provided three hundred names can be secured. Will all entomologists desirous of aiding in the publication of such an annual, send in their subscriptions in advance, that the means of publishing such a useful book be afforded at the outset? Subscriptions, *seventy-five cents* a copy, received by W. S. West, Peabody Academy of Science, Salem, Mass.

Will our scientific and secular exchanges please copy this prospectus, and urge their readers to encourage the undertaking?

VOYAGE THROUGH THE GRAND CANON OF COLORADO.—An extract from the Transactions of the St. Louis Academy of Natural Science, Vol. II, pp. 449–453, contains a report by C. C. Parry, Assistant Geologist to J. D. Parry, President of the Eastern Division of the Union Pacific Railroad, giving a detailed account of the extraordinary voyage of James White of Callville, through the Grand Cañon. It seems that a party of three, of which he was one, was attacked by Indians on the banks of Grand River. Two of them escaped, built a raft and embarked upon it, preferring to risk the chance of reaching the settlements by way of the river, than the certain destruction of a retreat by land. About thirty miles beyond they passed the mouth of Green River, and were in the Colorado proper. Henceforth their way lay through the sullen and hitherto untraversed depths of the Grand Cañon, whose precipices gradually rise above the narrowing stream a little below the junction. The mouth of the San Juan was passed, some forty miles farther on, without accident, but on the fourth day out they encountered the first rapids. These swept off Henry Strole, and all the provisions, leaving White to pursue the voyage alone. One hundred and eighty miles farther on he passed the mouth of the Colorado Chiquito, after having passed through a series of "fearful" rapids, from which his escape upon a raft threatening every moment to come to pieces, was hardly less than miraculous.

From this place to Callville, Mr. Parry estimates the distance at three hundred miles. The time occupied in the journey was fourteen days, "during seven of which Mr. White was without food of any description." The geographical discoveries consist in the approximate estimates of the length of the river, made upon the supposed rate of the flow of the current. These, as have been given, make the inaccessible parts of the Colorado proper, about five hundred miles long, following the winding of the bed, which is "very crooked." The location of the mouths of the San Juan, Colorado Chiquito, and his general description of the character of the sides of the Cañon are also valuable. These are described as "flaring" outwards, and composed throughout the greater part of their extent of light-colored rocks, probably the "Cretaceous and lower stratified rocks" of Newberry. The "average elevation" is placed at 3,000 feet, which is below that supposed by Ives and Newberry to be the average depth of the chasm. If this is so, the bed of the stream must rise rapidly above the point at which it was approached by the Ives expedition, for at that place they made it out with the aid of their instruments to be 5,000 feet. It is not generally known that Dr. Newberry has been upon a second expedition to this remarkable region, and that the results, though written out before the war, still lay unpublished at Washington. When the report of this expedition is published we may hope for more accurate information.

Chemical News.—The American publishers of the Chemical News propose to add to the English edition a Supplement, containing Notices of the current Progress of Chemistry and the Physical Sciences in America, Notices of New Books, Review of the Markets, Movements in Trade, etc. The new feature was inaugurated in the December issue, and is under the editorial charge of Professor Charles A. Seeley.

Insect Extinguisher.—Mingled with considerable irrelevant matter, this little pamphlet contains some useful hints on the means of exterminating insects, which will be well worth its price (12 cts.) to agriculturists. Address J. Treat, Vineland, N. J.

NATURAL HISTORY MISCELLANY.

BOTANY.

White Varieties of Flowers.—In the Naturalist for June Mr. Broadhead mentions having seen *Lobelia syphilitica* and *Vernonia Noveboracensis* with white flowers. Of the same species of *Lobelia* I saw several white flowered specimens last September, near Rock Lake, in Jefferson County, Wisconsin. I have also observed the white flowered variety of *Vernonia Noveboracensis* in Pratt County, Illinois, during the past season. I can add to the list of floral albinos, already brought to notice in

the NATURALIST, the following, which I believe have not been mentioned by any writer, viz.: *Viola cucullata, Viola sagittata, Phlox pilosa*, and *Gerardia aspera*. All these have fallen under my observation in Southern Wisconsin during the past eight years. I observe also that in all of these plants the *foliage* is paler in the white flowered specimens. For example: *Gerardia aspera* has, in Wisconsin, almost always a purple stem and purplish foliage, but in the albino specimens, of which I have seen at least half a dozen, the stem and leaves were a very light green.

In the November number Mr. Meehan mentions a Saxifraga as growing wild with double flowers, and enquires, "Has any other double flower been found?" I reply that some six years since a rue anemone (*Anemone Thalictroides*) grew in a wood pasture near Albion, Wisconsin, with flowers perfectly double. After being transplanted to my mother's flower garden, it never flowered again, and finally disappeared. I also took a specimen of *Helianthus giganteus*, in October of the last year, from its native prairie soil, in Pratt County, Illinois, with all the flowers ligulate in the manner of the so-called double flowers of the florists of this natural order.—EDWARD L. GREENE, *Decatur, Ill.*

MORE WHITE VARIETIES.—The past season appears to have been unusually prolific in white flowers. In north-eastern Minnesota (shore of Lake Superior) I discovered a marked white variety of *Lobelia Kalmii L.* The plant was devoid of the purple tinge which generally pervades it more or less, and the corolla was pure white with a few pale yellow markings. It grew in abundance on damp rocks, in close proximity to the common form. I had observed previously the *Erigeron Philadelphicum* L., with white rays, which are usually of purple or flesh color. A friend informs me he has found this year, with white flowers, *Spirea tomentosa* L., *Cirsium arvense* Scop., *Trifolium pratense* L., *Statice limonium* L., and *Gentiana saponaria* var. *linearis* Gr. We have had reported also *Cypripedium arietinum* R. Brown, and *Lobelia syphilitica* L. It would be most interesting to know if there is any influence of the season to produce this apparent abundance of white varieties, whether those variations are permanent, etc. I wish to call the attention of your readers to the subject, so that if any corroborative facts have fallen under their observation, they may kindly inform us. This may furnish conclusive testimony that certain seasons are remarkable in this way, and that that of 1868 was one of them.

From the *Lobelia cardinalis* L., and *L. syphilitica* L., having been not unfrequently found with white flowers, and a white variety of the *L. Kalmii* L. being now added to the group, it would appear that the genus is inclined to produce white varieties. Some plants have undoubtedly a peculiar inclination to this. I would add that, several years ago, I saw a single instance of *Campanula rotundifolia* L. with a white bell. The tendency of species all through creation to produce varieties is a subject of such deep interest, that anything which casts light on it is of special value.—HENRY GILLMAN, *Detroit, Michigan.*

Bidens frondosa. — The common Beggar-ticks are classified by the standard botanical authors as *rayless*, but Asa Gray (Manual, 2d. Ed., page 222) says, Dr. Sartwell has found it in western New York with one or two small rays. I have observed rays on this plant for several years. For the last two summers I have observed it more closely, and never found one plant without rays. The full number of rays are not always seen, but frequently the full number of eight rays are present. The ray is small and very caducous. To be seen, the head must be watched every day as it is opening, for the beautiful little ray only remains a day or two after its appearance. This plant is very abundant here. I have observed rays on thousands of specimens, and now at the close of this season am entirely convinced that it does not exist in this region without rays. It grows very luxuriantly here, often seven or eight feet high; but whether one or eight feet high, it makes no difference. The rays can always be found by close watching.

From the continual presence of the ray in this region, I am inclined to believe that there is something different in its development here, compared with the *B. frondosa* L. at the East, for if the rays were present so frequently at the East, the several masters of this science there could not have failed to observe it. And therefore as the ray is not found at the East, would there be any impropriety in assigning this a specific, or at least a variety name? The leaves here are often seven-divided, and the lower leaflets have two little secondary leaflets at their bases. If any Eastern botanist wishes to cultivate it, and thus try the effect of climate on it, he can have seed by applying to me soon. — Henry Shimer, *Mt. Carroll, Ill.*

Bidens frondosa. — The earliest heads of flowers of *Bidens frondosa* are usually radiate, with from two to ten small rays. The later heads are usually not radiate. Is it so elsewhere? If any persons wish specimens of the *Scolopendrium officinarum*, etc., I can furnish them, as I have about one hundred and twenty-five specimens on hand I would like to exchange for other plants, especially southern ones. This fern grows in great abundance around Green Lake and vicinity, in this county. — Samuel N. Cowles, *Otisco, Onondago County, N. Y.*

Abnormal form of the Sensitive Fern. — I found growing near here this summer a curious abnormal form of *Onoclea sensibilis*, in which all the pinnæ on one side of the stipe, except one, are much contracted, rolled up, and filled with *sporangia*, as in the natural form of this fern, while those on the opposite side of the stipe are twice pinnate, very slightly revolute, and some of them slightly contracted, but without losing their foliaceous character and bearing fruit; dots covered with the indusium, as in the var. *obtusilobata*. The curious state of this plant would seem to be intermediate between the true form of *Onoclea sensibilis*, and the var. *obtusilobata*. It certainly is analogous to the latter, though presenting a curious union of both. Professor Gray, in the "Manual" states that some such form of *Struthiopteris* has been found, but whether such a state in this fern is often found, I am uncertain.

Plants agreeing well with the var. *obtusilobata* were found growing near this one, and from the same rootstock of the common species.—CLAUDE CRITTENDEN, *Rochester, N. Y.*

ZOÖLOGY.

THE BUTCHER BIRD AND MOTTLED OWL.—In Volume II, No. 7, page 380, the question is asked by Dr. Wood, if the *Collyrio borealis* has been known to return to animals which it has killed and empaled, or hung upon trees. Only one instance has come under my notice, and that was some years since, in the latter part of November. A Butcher bird returned to a pear tree upon which grasshoppers had been empaled and devoured them, though they had remained there some weeks and had become dry. I should like to ask any person who is acquainted with the habits of the Shrike if they kill and empale animals at all seasons of the year, or only two or three months preceding winter.

There is something singular with regard to the vision of the Mottled Owl, which the Doctor notices in an article on the Mottled Owl, in the same volume and number, on page 373. I was once in search of the nest of this owl, and in passing under an apple tree, I saw what seemed to be a part of a bird protruding from a limb of the tree, and in climbing up to the spot, I found a male Mottled Owl, with his head and shoulders thrust into a small cavity in the limb. I took him out and perched him upon my finger, where he stood for some minutes. I put my hand upon his back and smoothed down his feathers, when he would turn his head and look me full in the face and snap his bill. I stretched out his wings and handled him other ways. At last he flew in a direct line for an apple tree, standing about eight rods distant, and entered a hole in a rotten branch of the tree as readily as if it had been in the night-time. This occurred when the sun was shining brightly, at about noon.—AUGUSTUS FOWLER, *Danvers, Mass.*

SHEDDING OF THE HORNS OF THE AMERICAN ANTELOPE (*Antilocapra Americana* *).—My experience in regard to the shedding of antelope's horns is this: I have killed bucks and does in October and November, and the first of December, and after the heads have become dry, the horns slip from the pith, which appeared to extend to a little above the prong; but the prong was only noticed as extending upwards, and not beyond a line extending downwards towards the but of the horn; and in spring I have found on bucks and does a soft hairy horn within an inch or two of the point which would become hard. Does' horns are about one-half or a third of the length of those of the bucks.

I owned a buck which I got when about four months old, and in March he had horns about one and a half inches long, a little before he was a year old, and shed about three quarters of an inch, and as I kept him well, and castrated him in August (to keep him from leaving), he shed about

* Communicated in a letter received by the Smithsonian Institution, Washington, D. C.

two inches or more. They shed their horns about the first of January. They are very easily tamed so as to stand touching by one, but dislike to be rubbed on the back, their hair being so very brittle. They are fond of milk, bread, corn, etc., at any age. Unless they do without milk for a while when about a year old, they will not drink it. They also like a little salt at a time, sugar, candy, etc. I never found but one antelope horn shed on the plains, or heard of any being found (I have made many enquiries about it), and the one I found was partly eaten up by the wolves.—W. M. Hinman, *Fort Laramie*.

The Woodpecker and Sheldrake.—The Downy Woodpecker frequently spreads it wings against the bark to maintain its hold; the stiff quills performing the same office as the tail. It goes up the tree, along the horizontal branches, around the limb sidewise, then a short distance down the trunk, tail first, and lodges itself in the crotches to hammer. It strikes many deft little side blows, ceases work and clings some time as if to rest, with loose plumage, picking its breast and looking about.

Last spring when the Dusky Ducks were migrating, I noticed one morning a large flock separating, in the course of their flight, into distinct pairs. Soon uniting again, it is probable they were seeking their partners if not already mated.

As soon as, or even before the river has begun to open in spring, the Sheldrakes make their appearance, early in the morning, but seldom before sunrise; they fly from the sea, where they probably roost, up the stream. Sometimes they file along one after the other; more often they proceed in no regular order. When they are bound a long distance up stream, they fly high with regular beats, with necks outstretched, and the neutral light which is on them would seem to suggest the flock between dusk and the daylight. On their .return down stream, often in pairs or singly, or small parties, they fly close to the surface of the ice or water, and very swiftly. When anything alarms them on the bank, they sometimes croak. If attracted, they turn at a distance, retrace their flight, scale low over the water, throw out their webbed feet and stop with a splash. They look handsomely, their necks deeply curved, the male with such strong contrasts of black and white. They croak and dive with vigor, returning to the surface in a moment. They arise from the water easily, and are soon under good headway. I have never heard any noise from their wings be their flight ever so rapid. I have seen the male on alighting, thrust his bill straight into the air, shake his head, croak and swim away. This may be a token of suspicion, but it is also performed when there is no particular cause for alarm. The croaking noise sounds something like a duck's quack, and evidently expresses a good deal, as I am persuaded from observation on various occasions. One morning, after a cold night, the river was covered with thin ice. Three Sheldrakes came up, flying low, their heads were bent down as if to look closely; making a circuit and scaling close to the ice, they rose again, an old male croaking, saying plainly to my ears, "we can't get in

here." They swim about strongly, almost as if drawn by some powerful electrical attraction, and on coming to the surface after a dive, the head and neck are often thrown back in a very haughty manner. The very soundness of the season and the frozen shore seems in them; but perhaps their amative prospects may have something to do with this exuberance of spirits. It seems as if they could never die. Wounded birds frequently crawl upon the ice, but they do not seem to walk very well. Flocks will alight on the ice before going into the water sometimes, and it is not unusual for a pair to be seen sitting on the ice by a hole where frost-fish are taken. I have seen the Sheldrake standing on a ledge; its figure was awkward, but it did not stand as erect as some other birds whose legs are placed far behind. A little flock is sometimes seen in spring resting in a cove or inlet of the sea; some quite at their ease, others swimming about in that strong way we have alluded to, with necks outstretched.

The Sheldrakes seen on the breaking up of the rivers are as nothing compared to the quantity that follow along the shore a little later, when they come in flocks, from twelve to twenty, and even seventy-five; sometimes flying steadily, two or three deep, above the reach of shot, passing over the bays and headlands. The flocks all go in one direction,—east. Sometimes a few will be seen going in the other direction; but I have seen such turn before lost to vision, and come back again, as if conscious they were wrong. They frequently fly close to the water, as if to vary their journey, their wings evidently being strong enough to allow considerable freedom of will; but they rise from the surface of the water to a gunshot distance when they go over the headlands. If they see a person in the course of their flight, they swerve widely, but often a lone one will, without perturbation, go straight over the fowler. I noticed that most of the flocks in spring appeared to be made up of males. I was told that later the females came along in large flocks. I should like to know about this, and also why so few of these birds, comparatively, are seen in autumn? They are among the birds which form the rear of the great migratory flight in late spring, as well as among the first to appear early in the spring; and "spring ducks" and "spring sheldrake" are common terms at the shore, —everybody knows them. The white on the wings of these birds is noticeable when they are not high, and the dark line on the neck of the male can easily be seen at a gunshot distance, when he is below the eye. They sometimes scale to the water from a height, holding the wings stiff and a little inclined down. They are never as tranquil on the water as the coot, and I could never discover much in their gizzards early in the season, even of those which had been actively engaged. They sometimes swim in close to the shore, immerse their heads and necks, and persistently punch and glean among the pebbles and weeds. The Sheldrake's tail seems to be more a part of the body than do the tails of other water birds, the feathers of the back appearing to descend to the very tip almost; perhaps it can be used somewhat as a rudder when under water. The male is known as a handsome bird, his pure white neck remaining in our memory after being seen once. Its ruddy breast is flecked with artistic niceness; and its sides and

back are finely marked. There is also much character in his crest. The plumage of the female is also admired, with its soft red crested head, white throat, soft leaden back and white under parts. The bill of the female is shorter than that of the male.

The Sheldrake, swimming by the edge of the ice, with the cold snowy bank for a background, is as hardy a picture as New England can furnish. It is a stirring sight in spring, on a bright breezy day, to see the male, a crimson-eyed beauty, feeling fresh in spirits and in costume, going over the rocks, thinking only of the fête in the north.—WM. E. BARRY, *Kennebunk, Maine.*

THE DWARF THRUSH AGAIN.—I wish to rectify a mistake made in reference to a notice of the *Turdus nanus* being found in Waltham, given by Mr. Samuels, in the June number of the NATURALIST. By some accident, the description given by him at that time was not correct, and did not apply to the bird in question. I have, since that time, had two similar birds in my possession, both females; the first was shot May 25th, 1868, in a swampy wood; the second was shot September 21st of the same year. They all resembled *T. Swainsonii*, much more than *T. Pallasii*. The size is small, and there is a distinct bar across the wing; which, however, I do not consider anything more than a mark of immaturity, as it is to be found on the wings of all young thrushes. Taking this and other marks of immaturity into consideration, as they are exhibited by the specimens in question, I have decided them *all* to be young of *T. Swainsonii*.

In regard to the *T. Aliciæ* of Baird being found here or elsewhere, I would say that, having made a long series of careful measurements upon various members of the genus Turdus; and, having seen wide variations in size, and also in intensity of color, in different individuals of the same species, I have come to the conclusion that *T. Aliciæ* consists only of large and somewhat pale specimens of *T. Swainsonii*. I have seen specimens varying in intensity of color between the decidedly rufous sides of the head and breast of the typical *Swainsonii*, and the "faintest possible shade of yellowish red" of *T. Aliciæ*, with also wide variations in size. The largest and smallest measurement that I have made I will give. A male shot in Belmont, May 27th, 1868, in swampy woods, measures 7.76 inches in length; 12.65 in spread of wing; 4.30 wing; 4.00 tail. This bird is large enough truly to be a typical *T. Aliciæ*, but is unfortunately of a decided rufous upon the parts where it should be pale. Another bird shot in Waltham, October 9, 1867, a male, gives the following measurements: Length 6.70; spread 10.16; wing 3.40; tail 2.80 (this being in fact the very specimen described by Mr. Samuels as *T. nanus**). This bird is of a pale buff about the head and across the breast. By this it will be seen that *large* birds are sometimes *bright* in color, and *small* birds *pale*. I have also specimens that compare exactly, both in size and color, with the de-

*It is but just to say, however, that both Mr. Samuels and myself, at that time, thought the bird to be *T. nanus*, being deceived by the small size and its slight resemblance to *nanus*, as described by Prof. Baird. Mr. Samuels has since informed me of his doubts upon the subject.

scription of *T. Aliciæ* and *Swainsonii*. There is also very nearly as wide varieties in specimens of *T. Pallasii* which I have collected.

Without more evidence than is exhibited in the variations in size and intensity of color, in birds so variable in these particulars as I know the thrush to be, it seems to me that extreme caution should be used in deciding upon species.—C. J. MAYNARD.

HABITS OF SNIPES.—In a recent number of the NATURALIST, you ask if any of your readers have seen the snipe (*Scolopax Wilsonii*) alight in trees. I have noticed this in connection with another peculiarity, that of "drumming," as generally called late in the spring when shooting these beautiful little waders. Sometimes, at the report of a gun, a score or more would rise in a wisp, and after drumming awhile alight again. It has been at these times that I have seen them sitting on trees and old stumps, but more frequently on the common worm-fence; they perch, however, but a few moments before they are drumming again. On the northern shore of Lake Superior they have been seen, in fact are seen almost every spring, to come in countless multitudes across the lake, and immediately upon reaching land, alight on the trees in flocks, and rest for a considerable length of time; and although it has no connection with the subject, I would like to have it explained to me how it is that quite often in spring shooting, you find upon drawing your birds that in a day or two at most they would have laid an egg, and they are at least 1,500 miles from their breeding places, and have their nests to make after getting there, which would take altogether two or three days. I do not think it can be explained by saying they may breed south of the British American breeding-places; for in some seasons, like last spring, you will find three out of five in that condition.

Have any of your readers ever seen the Woodcock, *Scolopax minor*, perch on a tree or shrub? I saw one once that was unhurt, and another that was badly wounded. The first got entangled in the leaves and stems of a small bush, and perched on a small limb, and sat there four or five minutes. As I was not more than ten feet from him, I had a good opportunity to study him. The other was wounded late one evening and lost, and the next morning found perched in a bush, where he had remained all night, as proven by the signs underneath the twig on which he sat. He was unable to fly, which may account for it; but the other bird was an old bird, and had not been injured in any way.—WM. W. CASTLE, *Cleveland, Ohio.*

THE SEVENTEEN-YEAR LOCUST.—As it is stated in the NATURALIST that the eggs of the Seventeen-year Locust hatch out, and the larvæ leave the twigs to go into the ground in a few weeks from the time of deposit, I may mention that, since the twenty-eighth of July, I have kept in my study a number of twigs stung by the locust, for observation. No larvæ have yet appeared. Breaking one of the twigs a few minutes ago at the furrow of deposit, I found in it a number of the eggs, one-thirteenth of an inch long, and quite translucent under a pocket lens. The twigs have

been kept under a bell-glass, open at the top. The sun has had but limited access to my study in which they are. Can this explain their non-development? — H. HARTSHORNE, *Haverford College, Phila., Oct.* 17.

[We were by no means *sure* that the eggs of the Cicada hatch in about two weeks, but from the statements of observers, it seemed to us more probable at the time of writing the notes in the August number of the NATURALIST, that they hatched soon after they were laid, rather than forty or fifty days after, as stated by one author. In a very interesting article in the "American Entomologist" for December, page 66, Mr. Riley states that the eggs hatch in about six weeks after being deposited. — EDS.]

REASON OR INSTINCT. — Some years since when a great freshet had flooded the country at the summit of the Illinois and Michigan canal, a boatman observed an Opossum sitting on the top of a fence, part of which projected a foot above the surrounding waters. He took her off, and found in the sack fourteen young ones half-grown. She was so nearly famished that she made no demonstrations of hostility, but eat ravenously whatever was put before her, and soon became quite domesticated. She could easily have saved herself by swimming ashore, but evidently appreciated that it would be at the loss of her family. — J. S. CATON.

IS THE CROW A BIRD OF PREY? — A communication, in the NATURALIST for November, from Mr. Nauman, relates the pouncing down upon a chicken (*a la hawk*) and the carrying it off by a crow; and the enquiry is made whether this is a common practice with this bird. I suppose it is not very common, but in the month of May or June of this year, I saw a crow dash down upon a brood of young chickens, about sixty yards from my house, and carry one of them off, and in a second attempt a few days afterward, the quasi bird of prey failed to secure its prize. A member of my family witnessed a third instance, on which occasion the prey was carried off.

The fowls in the early part of the season appeared to look for no harm from those birds, but later they came to understand the danger, and uniformly fled to the shelter of the buildings, with cries of alarm upon the approach of crows, in the same way as it is their habit to do from hawks. — JOHN H. BARTHOLF, M. D., *Camp Grant, near Richmond, Va.*

ALBINO DEER AND CHIPMUNK. — Dr. Morgan, at Grand Rapids, Mich., has in his possession the skin and feet of the Common Deer (*Cervus Virginianus*), which was of an uniform pure white, with white eyes and black hoofs. It was observed repeatedly in that vicinity while a fawn accompanied by its dam, which was of the usual color. It was by common consent among the hunters left unmolested, with the intention to await a heavy snow, and then run it down and capture it alive. But the dogs did not coincide in this arrangement, and one day were found chasing it, and as it passed in an exhausted condition near a traveller, he caught it and cut its throat, and skinned it, so that the above trophies were all that could be obtained.

At Centerville, Mich., there is in the possession of a gentleman a com-

mon Chipmunk (*Tamias striatus*), which is of an immaculate white, with a pinkish skin and bright red eyes. There is not a spot or shade of any color except the white, and no trace of any markings whatever. This animal was brought into the house by a cat, but was rescued before any serious injury was inflicted, and it is now kept in a cage, and is a very lively as well as remarkable and interesting pet.—D. DARWIN HUGHES, *Marshall, Mich.*

THE ARGONAUT AND VITALITY OF SNAILS' EGGS.—Mr. John Ford endeavored to show the discrepancies in regard to the mode of generation and growth of the animal of *Argonauta Argo*, citing Madam Power's experiments, and concluding with the query that "if the male argonaut does not produce a shell, why were there no males hatched in Madam Power's aquarium?" Mr. W. L. Mactier exhibited a specimen of *Bulimus hæmastoma*, with the eggs and young shell, and remarked that "the specimens belong to Dr. Samuel Lewis, a member of the section." The shell and eggs were received about three years ago from Barbadoes. A few months ago, on examining his cabinet, the doctor discovered that two of the shells had hatched. It is quite curious to speculate upon the circumstances which have occurred to develop these young shells. The tenacity of life in the mollusca is now well known, but what circumstances operate to retard or favor the development in *private cabinets* we believe is not so well known. Mr. W. M. Gabb followed, speaking of the vitality of the eggs of *Limax Columbianus*, which had hatched after being confined in his cabinet at least three years.—*Proceedings of the Conchological Section of the Academy of Natural Sciences, Philadelphia.*

HONEY BEE KILLED BY SILK-WEED POLLEN.—Enclosed I hand you a honey-bee for examination. I found it lying on the ground, far from any apiary, nearly dead, ceasing to move soon after I picked it up. I found its legs bound together by a great number of those minute yellow disks with their articulate stems, that can be seen by the naked eye. I presume its death was caused by starvation alone, its entanglement causing all its efforts to be directed to freeing itself, but without avail. I presume I pulled off one-half of the disks that were upon it at first, before I thought of saving it for microscopic examination. Mr. Langstroth speaks of bees becoming entangled in the silk-weed blossoms. This may be a case. —ROBERT BICKFORD, *Seneca Falls, N. Y.*

[These bodies are, as you surmise, the packets of pollen of the silk-weed, Asclepias, which adheres by a glutinous substance to wasps and bees frequenting the flowers. They are figured and fully described in the NATURALIST, Vol. I, p. 105, and the "Guide to the Study of Insects," p. 165. We have never before heard of an insect actually loosing its life from this cause, and the case is a very interesting one.—EDS.]

LUMINOUS LARVÆ.—On p. 432 of the NATURALIST, fig. 4, is figured a luminous larva, which is not referred to any genus and species. I suppose it is the larva of one of the species of *Melanactes* (Elateridæ), of which I described two or three, and figured one, in the Proceedings of the Ento-

mological Society of Philadelphia, 1862. Compare especially what I say about the *smaller larva* which I had at that time, and which was found by Mr. Haldeman. Compare also the supplement to my article, confirming the opinion that those larvæ are luminous, and that they belong to *Melanactes*, which short supplement is to be found in the report of the stated meetings of the Society, held April 10, 1865. I thought that this notice might be interesting to you, and draw your attention to those remarkable, large luminous larvæ, which, until very recently, have entirely escaped attention.—R. Osten Sacken, *New York*.

Snails Injurious to the Strawberry.—Herewith I send you some specimens of the *Pupilla fallax* of Say. There is nothing remarkable about the shells themselves, but I wish them to bear testimony to an interesting fact in relation to their habits, which is new to me. Writers on agriculture have studied and written much about insects that are injurious to vegetation, and we have heard of the ravages of the garden snail, *H. splendida* Drap. of Europe; also of the garden slug; but up to this time I do not know that the little mollusks now arraigned have ever been suspected as garden depredators. Mr. and Mrs. Chappellsmith of our town, both students of nature, and intelligent observers, found their strawberry plants dying rapidly, and on searching for the cause discovered these mollusks at work upon the stems and crowns of the plants, rasping off the outer coating, and sucking their juices in such a manner as to cause them to decay. Mr. C. found as many as forty upon one plant, and thinks they have killed several thousands upon the different beds. Though more abundant on the strawberry, he has found them on a variety of plants. Since attention has been called to the depredations of these minute mollusks, they have been found at work upon the strawberry plants in all the gardens examined. For a number of years I have noticed *Helix alternata* Say, in our gardens, and they are becoming more and more abundant; but we have never detected them in doing any mischief.—E. T. Cox, *New Harmony, Ind.*

Ravages of the Alypia Octomaculata.—That a man should desire to raise his own Isabellas is laudable and praiseworthy; and I see no reason why such desire should exist exclusively in the breasts of our bucolic friends. The inhabitants of New York, as a general thing, clearly, are of the same opinion, as is evidenced by the number of grape-vines ornamenting the doors and trellis-work of the houses of our citizens; not, of course, in the benighted regions of Wall street, but up-town; say from Sixteenth street, northward. A friend of mine residing in Thirty-fourth street, showed me, in March last, a very fine vine, which he calculated would produce him sundry pounds of very choice grapes, and in the pride of his heart he invited me to "call along" occasionally, and feast my eyes on the gradual development of the incipient bunches. Thinking that August would be a good month for my visit, I "called along," wondering in my mind whether my friend would, when the time of ripe grapes came, desire me to help myself out of his abundance; or whether he in-

tended to surprise me with a little basket full of nice bunches, garnished with crisp green leaves. The first glance at the grape-vine banished all doubts on this point. There were an abundance of bunches on the vine, in a rather immature condition of course, but of foliage there was not a trace. Of course I expressed my surprise, though, for certain reasons, I felt none; and asked my friend why he selected a species of vine for shelter, ornament, and use, which produced no foliage. He rebuked my ignorance pretty sharply, and told me that a few weeks before the tree was covered with leaves; but, for some inexplicable reason, they had all disappeared — eaten, he guessed, by something. He guessed right. There were at least a hundred of the larva of *A. octomaculata*, the rear guard of a mighty host, wandering about the branches, apparently for the purpose of making sure that no little particle of a leaf was left undevoured. Pretty little things they were, with harmoniously blended colors of black, yellow and blue, but so terribly destructive! I had the curiosity to walk through all the streets to the east of Third avenue, as low as Twenty-Third street, and every vine was in the same predicament. If grape-leaves, instead of fig-leaves, had been in request for making aprons, and our Alypia had been in existence at the time, I doubt if in the whole of the Garden of Eden enough material would have been found to make a garment of decent size. The destruction of the crop for 1868 was complete.

This was bad. But it was not half so bad as the helpless ignorance which possessed nearly all of the unfortunate owners of vines. Scarcely one that I conversed with had the remotest idea of the cause of the disaster, and when I explained that it was the caterpillar of a beautiful little black moth, with eight whitish yellow spots on its wings, which had eaten up the foliage, my assertion was received with such a smile of incredulity, as convinced me that there is no use in trying to humbug such very sharp fellows as are the New York grape growers.

It is a little remarkable, however, that the destruction was confined to the eastern part of the city. I saw several luxuriant vines on the western side; and across the river at Hoboken, and at Hudson City, not a trace of *A. octomaculata* was discernible.

The insect, then, is very local in its habits, and it is a day-flier; and, from these facts, I infer that its ravages may be very materially checked. A little poisoned molasses, exposed in the neighborhood of the vine, would operate on the perfect insect; while a good syringing, with *soft soap* and water, would bring down the caterpillers effectually. I should like some one to try these remedies, and if their gratitude for my good advice should be so exuberant as to require an outlet, why I have no objection to receiving a few bunches of their first ripe grapes, if such a step would afford them any relief. — W. V. ANDREWS.

THE BLUE-BIRD. — I see that Dr. T. W. Brewer, in his article in the Atlantic Almanac for 1868, on the "Song-birds of North America," speaks of the Blue-bird as having made its appearance in Massachusetts once as early as the 15th of February. I have met them once on the Cape earlier

than that. On the 2d of February, 1867, one of the males was twittering about the orchard where we then lived, at East Falmouth, on the shore of Vineyard Sound. A few days after I received a letter from a friend at Sandwich, stating that he saw several of them *during the last week of January*. As he did not give me the day of the month, I cannot give it, but of my date, the 2d of February, I am positive, as I took a note of it at the time. As Sandwich is fifteen miles to the north of East Falmouth, the fact of their being seen there the soonest is quite interesting. In 1866, they appeared March 4th at East Falmouth, and in 1868, not until March 11th. In 1867 we had very severe weather after their early appearance, but they remained.—W. C. Fish.

A Viviparous Echinoderm.—Dr. Edward Grube describes an Echinoid from the Chinese seas, under the name of *Anochanus*, which actually produces young Echini, like itself, having spines, feet, and even pedicellariæ. This discovery is of remarkable interest, for it adds one more to the many diverse methods of reproduction known among Echinoderms, and completes the parallel which they present to the worms. We now know, in both groups, of animals laying eggs which produce embryos developing directly into the adult form; of others which present strange larval conditions which either become completely altered, so as to form the adults, or bud off from their interiors a small mass of living tissue which becomes the adult, leaving the larva to perish. We know, in both groups, of hermaphrodites and of diœcious species, and now we have added a viviparous form of Echinoderm, such as was previously observed in some Nemertian worms. We have yet to discover among the Echinoderms the various modifications of asexual reproduction, by pseudova, fission, or true parthenogenesis; the first two of which methods (especially fission) are so well known among worms.—*Quarterly Journal of Science, London.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Institute of Science, Letters and Art. On the evening of Dec. 29, 1868, a large number of the members of the National Institute, as well as those interested in the work, met in New York City to organize two of the Academies, *i. e.*, that of the Natural Sciences, and that of the Mathematical and Physical Sciences, into which the Institute is divided. We should mention that after several preliminary meetings, a Constitution was drafted, and on May 29th a copy of it, with the following circular, was sent to the leading scholars of the country:

"The lack of any means of easy intercourse and free communication, and consequently of united effort and mutual support, has been felt for some time past by men of letters, artists, and scientific men in the United States. They constantly find themselves reminded of this lack by their weakness as a class, because although a class

they are not a body with a recognized organization. Scattered over a wide expanse of country, they are, from this dispersion and this want, no less morally than physically isolated. There is no authority other than the temporary and shifting, although in some respects valuable one, of public opinion, by which their claims may be passed upon—no tribunal of their peers or of those of their own class to whose experience and judgment they would willingly defer—no representative council, the stamp of whose approval would be acknowledged by the public as well as by themselves. From the lack of such a centre of union, of communication, and of combined action, they, and with them the cause of truth and knowledge, and the public welfare, suffer. In the hope, therefore, of compassing these objects, we propose to establish a National Institute of Letters, Art and Science, upon a plan outlined in a Constitution accompanying this Circular. We ask your coöperation."

After several meetings a Constitution was finally adopted founded on that of the French Institute, but adapted to the genius of our country. Under this Constitution several Academies have been or will be organized, and their meetings will be held in New York City. The following officers of the Academy of Natural Sciences were elected: For President, JOSEPH LEIDY, M. D.; for Vice President, JOHN S. NEWBERRY, M. D.; for Secretary, CHARLES A. JOY, Ph. D.; for Treasurer, J. CARSON BREVOORT, M. A. For members of the Council, JEFFRIES WYMAN, M. D., and SPENCER F. BAIRD.

If, as it promises to do, the National Institute will bind together and thus efficiently guide and control the army of workers in letters, science and art, a new era has dawned for the development of knowledge and its practical results in America. The National Institute certainly embraces the best talent and learning in the land; it only needs in addition, as has been remarked, an endowment of at least a million of dollars with which to begin its operations. At the outset it should place its officers on salaries, that their time may be devoted entirely to its service; should aid inquirers in making researches; should have the means of publishing its transactions and proceedings on a scale worthy of its liberal organization; and as its local habitation is in the city of New York, to the monied men of that great and wealthy city must it look for the moral and pecuniary support necessary for its life and final success. Such a National Institute in no way conflicts with the American Association for the Advancement of Science, which is a peripatetic body, meeting from place to place in the summer holidays, and we know of no other organization which would so fully meet the wants of the people.

ANSWERS TO CORRESPONDENTS.

J. F. A., Salem.—The presence of plants in sleeping rooms, is a thing to be avoided for several reasons. First, the leaves of growing plants, during the hours of daylight, constantly absorb a large amount of carbonic acid from the air; and this, by the action of the light, is decomposed; and the carbon goes to feed the plant, while the oxygen is exhaled. When light is withdrawn, this process stops, and any carbonic acid remaining undecomposed within the leaf-tissues is liable to escape again; thus to some extent, vitiating the atmosphere. This is not a great matter however, and indeed plants in *leaf only* are not chargeable with much of this kind of mischief. But plants in flower exhale carbonic acid freely at all times; for in all the processes connected with fertilization and fruiting, the starch and sugar found before in the tissues are being taken up and decomposed, part going to furnish the new products deposited in the seed, and part suffering complete reversion to its old form, first into acetic acid, and then into the

original carbonic acid, which is thus plentifully thrown out upon the air, which has at the same time been robbed of a share of oxygen to effect the change. Besides the presence of carbonic acid, flowering plants yield exhalations of many essential oils, and natural odors of various sorts, all of which, in close situations, are liable to cause injury by long breathing, though some may be very pleasant when moderately employed. For these reasons it is understood at present that though plants in *leaf only* may be tolerated in sleeping rooms, yet they had better not be kept there, and no others should be at any time.—C. M. TRACY.

G. W. S., Grand Rapids, Mich.—The only work on American Spiders, is a series of illustrated papers, by N. M. Hentz, in the Journal (Vols. 1–6) and Proceedings (Vol. 11) of the Boston Society of Natural History. The best general works are Blackwall's Spiders of Great Britain, 4to, published by the Ray Society, London, and Histoire Naturelle des Araignées, par E. Simon. 8vo, with 207 figures. Paris, Roret, 1864.

J. W. J., Middleboro, Mass.—Your specimen is the *Botryllus Schlosseri*, a compound tunicate mollusk. It will be described and figured in the new edition of Gould's Invertebrates of Massachusetts.

W. H. D., Troy, N. Y.—Your specimen is the Hair-worm (*Gordius*). See NATURALIST, Vol. I, p. 556.

E. L. G., Decatur, Ill.—See Darby's Botany of the Southern States.

G. W. L., Long Point, Texas.—"I saw a hawk catch an owl the other day. Is it a common thing for hawks to catch owls?" We have not heard of such an instance before. Have any of our readers?

L. B. C., Richmond, Ind.—"I enclose you a strange piece of fungus found here. The piece is oval, and about four inches across the face. When first taken, of a snow whiteness, except at the point of each stalk, where there is a small pink speck. These pink specks have increased more than four times their original size since first taken (eight days). They have also grown darker red all the time. It was found growing point downwards, in the upper part of a cavity in a beach tree, still growing, about four feet from the ground."—It is a young specimen of the *Hydnum erinaceum*.—J. L. R.

W. C. J., Newburyport, Mass.—The specimen found in the stomach of the cod was a Sea-cucumber (*Pentacta frondosa*), which is abundant in ten fathoms, hard bottom, along our whole New England coast.

C. W., Weathersfield, Conn.—The minute insect infesting the pinks in your house, and which spins a thread like a spider, is a Mite (*Acarus*). The little pink mite does considerable damage to roses, spinning webs, and eating holes in the leaves. The best remedy is to apply powdered sulphur with a pair of bellows, for which contrivance several patents have been taken out.

J. A. H. B., Falkirk, N. B.—The works of Professor Baird comprise all you want. Apply to the Smithsonian Institution for "A List of the Birds of North America."

W. C. F., Eastham, Mass.—The bird is the Pine Creeping Warbler, *Dendroica pina*.

W. P. R., Richmond, Va.—The sphinx, which was broken in pieces, is the *Philampelus vitis* of Harris. We would like specimens for our museum.

BOOKS RECEIVED.

List of the Shell-bearing Mollusca of Michigan, especially of Kent and adjoining Counties. By A. O. Currier. Published by the Kent Scientific Institute, Grand Rapids, Mich. 1868. 8vo, pp. 12.

American Bee Journal. January, 1869. Washington, D. C.

Cosmos. November 21; December 12. Paris.

Descriptions of twelve new species of Unionidæ from South America. Notes on some members of the Feldspar Family [with twelve other short articles extracted from the Proceedings of the Academy of Natural Sciences, Philadelphia]. Philadelphia, 1868. 8vo, pp. 32.

Future of Vineland. By Joseph Treat. 12mo, pp. 21. Price 15 cents.

Insect Extinguisher. By Joseph Treat. Vineland, N. J. 12mo, pp. 15. Price 12 cts.

Field. November 28, December 5. London.

Land and Water. November 7, 14, 21, 1868. London.

Chemical News. December, 1868. New York.

The Illustrated Annual Register of Rural Affairs for 1869, *with one hundred and thirty Engravings.* Albany, N. Y. Luther Tucker & Son. Price 30 cents.

Scientific Opinion. November, 1868. London.

Entomologist's Monthly Magazine. May–November, 1868.

Notes on the Later Extinct Floras of North America, with Descriptions of some New Species of Fossil Plants from the Cretaceous and Tertiary Strata. By J. S. Newberry. New York. 8vo, pp. 76.

GLOSSARY.*

Acanthastræa (Gr. *akanthos*, the acanthus, bear's foot; *aster*, a star). A genus of corals.
Ambulacral. Relating to furrows in the echinoderms (sea-urchins, star-fish, etc.), containing pores through which the so-called "feet" are protruded when the animal moves.
Ammonites. A genus of fossil cephalopoda allied to the nautilus.
Andesite. Also called Andesine, differing from oligoclase only in the smaller proportion of silica.
Anodonta. A genus of fresh-water mussels.
Atrypa. A genus of brachiopod shells.
Augitic. Composed of augite or pyroxene; oblique prismatic crystals with cleavage parallel to the faces. Colors from light green to black.

Bacteriums. Excessively low monad-like organisms.
Bromeliaceous plants comprise the Pine-apple and *Tillandsia*, or "Long Moss" of the South.

Caducous. Dropping off; ready to fall.
Cassis (Lat., a helmet). The Helmet-shell.
Cecidomyia (Gr. *kekis*, vapor; *muzo*, to suck) A genus of dipterous gall-flies.
Cedreala odorata. The "West Indian Cedar;" not however a true cedar.
Clypeus. A part assisting to form the front of an insect's head, situated below the antennæ, and bounded in front by the *labrum*, or upper lip.
Cœcum, pl. *cœca.* In fishes and the lower animals blind sacs opening into the intestine.
Columbella. Lat. diminutive of *columba*, a dove. A genus of shells.
Corallum. In corals, the polyp-stock, *i. e.* the whole colony of coral animals.
Corticifera (Lat. *cortex*, bark; *ferens*, bearing). A genus of corals.
Costæ (Lat. ribs, ridges). In shells the ridges encircling the whorls. (The ridges running parallel with the suture are not usually called costæ.)
Cyperaceæ † (Lat. *cyperus*). The Sedge family.

Dimerous. Made up of two parts, or its organs in twos.
Dinosaurian. Relating to an order of extinct gigantic lizards.
Dolerite. An igneous rock of the augitic series "composed of labradorite and augite, often with magnetic iron."
Draba. The Whitlow-grass, a genus of the Mustard family.

Echinaster (Gr. *echinos*, sea-urchin; *aster*, star). A genus of star-fish.
Echinometra (Gr. *echinos*; *metra*, a matrix) A genus of echini.
Echinorhynchus (Gr. *echinos*; *rhugchos*, a proboscis). A genus of entozoa or intestinal worms.
Elasmognathus. A genus of tapirs.
Exindusioid. Not having an *indusium* (Lat. shirt). The involucre or covering of the thecæ (spore-cases) of ferns.

Favia (Lat. *favus*). A genus of corals.
Fission. Generation by self division, as seen in many infusorial animals and plants.

Gorgonia (pl. æ, Lat. mythological name). A genus of corals.
Graptolites. A group of fossil animals, generally supposed to be mollusks of the bryozoan type.

Habenaria. The Rein-orchis.
Halcyonoid. Like halcyonium; a genus of polyps.
Heliastræa (Gr. *helios*, sun; *aster*, star). A genus of corals.
Heterogeny. The doctrine of spontaneous generation.

Inoceramus (Gr. *is*, fiber; *keramos*, shell). A genus of fossil shells somewhat like an oyster.
Inoperculate. Without an operculum.

Labellum. The odd petal in the orchis family.
Lespedeza. The Bush-clover; a genus of the Pulse family.
Leucitophyr. A volcanic rock of the basaltic series, consisting of augite and leucite.
Ligulate. Strap-shaped.
Liparite. Used by Richtofen to designate porphyritic rhyolite.
Lithobius. A genus of centipedes.
Lithoidic. Meaning stone-like.
Lithological. Relating to lithology; the study of the mineralogical and chemical composition of rocks.

Megaptera (Gr. *megas*, great; *pteron*, wing). A genus of whales, to which the "Hump-backed" whale belongs.
Millepora (Lat. *mille*, thousand; *porus*, pore, hole). A genus of corals.
Monads. A genus of excessively minute protozoa, or animalcules, of jelly-like consistency.

* No terms are explained here which can be found in the Glossary of Vol. I.
† The derivations and meaning of botanical names are fully given in Gray's Manual of Botany.

Monotropa. The Indian Pipe, Pine-sap; a genus of the Heath family.
Mussa. A genus of corals.

Nevadite. Granitic rhyolite.

Ocellus. The simple eye, supplementary to the large compound eyes of insects.
Oligoclase. A lime and soda feldspar, very like albite in appearance.
Ophiura (Gr. *ophis*, a snake; *oura*, tail). The Snake-star, Sand-star; a genus of echinoderms.
Oreaster. A genus of star-fish.
Orobanchaceæ. The Broom-rape family.

Parthenogenesis. Reproduction without the interposition of the male, as in the summer broods of plant-lice (Aphis).
Pedicellariæ. Little bodies like birds' bills, on star-fish and sea-urchins.
Perianth. The leaves of the flower generally, especially when we cannot readily distinguish them into calyx and corolla.
Petrogenetic. Means, literally, born of a stone.
Pinnate. With leaves divided like a feather.
Porites (Lat. *porus*, pore). A genus of corals.
Propylite. Third order of volcanic rocks, according to Richtofen.
Prothorax. The first or front ring of the thorax in insects. The *mesothorax* is the middle, and the *metathorax* is the third or hinder ring. The *peduncle* connects the thorax and abdomen.
Protichnites. Footprints of ancient extinct animals, supposed to be allied to the horse shoe crab.
Pseudova. Unimpregnated eggs which produce young, as in those laid by virgin Aphides.
Pteridologists. Students of ferns.
Pterodactyle. A genus of winged reptiles resembling bats.
Pulmonates. Land snails.

Revolute. Rolled backwards.
Rhyolite. First order of volcanic rocks in Richtofen's system, defined by him as trachyte, with the addition of silica.

Sacral. Relating to the sacrum (the subterminal bones of the vertebral column, forming part of the hinder wall of the pelvis).
Sessile. Not stalked, pedicelled or pedunculated.
Siderastræa (Lat. *sidereus*, relating to a star; *aster*). A genus of corals.
Squalodon. A genus of sharks.
Sporangia. Spore-cases.
Strontian. A mineral first found at Strontian, Scotland.
Struthious. Relating to the ostrich, Struthio.

Talus. The collection of pieces of rock and dirt which accumulates at the foot of a cliff or bank.
Tapiridæ. The family of tapirs.
Thallus (Gr. *thallos*, a frond). The vegetative system of lichens, combining root, stem, and leaves in one organ.
Tibiæ. The shank-bone. In insects the fourth joint of the leg, placed next to the *tarsus*, or toe-joints.
Trabicular (L. *trabs*, *trabis*, a beam). Relating to the structure of a polyp cell.
Trachyte. A volcanic rock composed of glassy feldspar, hornblende, and perhaps a little quartz and mica; usually porous.

Zygodactyles. The Woodpeckers.

ABBREVIATIONS.—*Lep.*, Lepeletier de St. Fargeau. *L.*, Linnæus. *Sauss.*, Saussure. *Somm.*, Sommer.

CORRECTIONS TO GLOSSARY FOR VOL. I.—After *Calypso*, add: A genus of the orchid family. *Cycads* are plants with somewhat the aspect of palms or tree-ferns, but in no way related to them. They belong to the same group with the pine and other conifers. *Dimorphism.* Add, "after animal" or plant. *Nephroma* is a genus of lichens. On p. 524, for 224 read 524, and on p. 688 at bottom, for 224 read 524.

ERRATA TO VOL. II.—Page 97, 14th line from top, for 78,000, read 87,000. Page 60, line 9, for *middle branches*, read *thick branches*. Page 61, line 6, for *submerged*, read *submarginal*. Page 71, line 9, for *Pariaba*, read *Paraiba*. Page 166, line 24, for *Cretacean*, read *Cetacean*. Page 111, line 33, for *lines*, read *times*. Page 233, line 8, for *rivulsari*, read *rivularis*. Page 233, line 11, for *E legans*, read *elegans*. Page 235, line 22, for *plumva*, read *plumosa*. Page 235, line 26, for *Callithaminons*, read *Callithamnions*. Page 331, line 36, for *their*, read *its*. Page 334, line 2, for *one*, read *our*; line 7, for *are*, read *is*. Page 165, the *Otiorhynchus sulcatus* is figured by mistake instead of *Hylobius pales*. Page 220, line 22, for *Gelechia*, read *Penthina*. Page 450, line 6, for *and* of the fire-hearths, read *or*, etc. Page 454, in explanation of Fig. 8, for *natural* size, read *half-natural* size. Page 455, line 7, for *Mr.*, read *Dr.*; line 28, after namely, *dele* comma. Page 461, line 8, for *on top*, read *on the top*. Page 462, line 20, for *longer*, read *larger*.